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PHOTOGRAPHY
WITHOUT FAILURES

PHOTOGRAPHY WITHOUT FAILURES

SHOWING THE BEGINNER

BY WORD AND PICTURE

HOW TO BECOME

A SUCCESSFUL PHOTOGRAPHER



LONDON

GEORGE ROUTLEDGE AND SONS, LTD.

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INTRODUCTORY NOTE

IN these days nobody can say that photography is difficult. Its secret lies in not making mistakes ; the rest is easy. But in photography, as in everything else in life, before we can achieve success we must master the various stages. A child has to learn his A B C before he can read and write, and the amateur in photography must make himself familiar with the basic principles and essentials of photographic technique.

This little book is designed to help him. It is not written for the expert, and deals only with those fundamentals which it is essential for the beginner to grasp. It is concerned with the elementary principles of exposure, development, and printing. And its method is based upon a thorough study of the causes of those failures which are so often a nuisance to the beginner, failures which are all the more annoying because, though they might easily have been avoided, it is impossible to rectify them when once they have happened.

What this book does is to allow these mistakes to speak for themselves. The pictures with which

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it is illustrated represent the commonest of them, affording a series of horrible examples from which the beginner can hardly fail to profit. In reality, very little technical knowledge is required, and if, by the aid of this book the beginner is enabled to acquire it, the author will have achieved all he set out to do.

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TAKING THE PHOTOGRAPH

THE making of a photographic picture begins with the exposure. This is the one means to the end we have in view, which is to create the actual foundation from which we shall later obtain the picture itself.

Before we can have a good picture we must have a good negative, and the more carefully we set about making the exposure, the greater our chances of success will be. It is perfectly easy for anyone to learn how to make pictures which are technically faultless, and how to recognize at a glance the signs of careless exposure or other defects in technique.

There are so many different points to be considered when taking a photograph that it is not difficult to go wrong. But it is always possible to avoid pitfalls when one knows of their existence and takes the necessary care. In photography there are two factors which should be considered absolutely vital :

Accurate focussing,
Correct exposure.

FOCUSSING

As a general rule—there are exceptions, but they do not concern the beginner—we do not consider any photograph satisfactory unless it is sharp and clear all over. To secure this effect, the camera must be properly focussed.

When focussing, we must be careful to make sure whether the main subject of our picture is close to the camera or a long way off. If, for example, we try to take an object no more than 10 or 12 feet away with the camera pulled out as far as it will go, it will appear in the picture like Fig. 1, confused and blurry, with only objects in the background appearing clearly.

The reason for this is to be found in the definite dependence of the lens upon optical laws which largely determine its capacity to reproduce an object accurately. One of the most important of these laws, and one which must always be remembered when taking a photograph, is that which controls what we call "the depth of focus" of a lens.

Every lens, whether cheap or dear, is subject to this law which allows it to reproduce sharply only a certain definite portion of a scene or object which, to the eye, seems sharp all over. All the parts of the picture which lie in front of or behind this portion appear more or less blurred, according to their distance from the area covered by the depth of focus. This depth of focus varies. It is affected by the aperture of the lens and by its

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focal length. When the aperture is reduced the depth of focus becomes greater, and vice versa,



Fig. 1.—Near Object taken with the Camera Focussed at "Infinity".

and it also increases as the focal length of the lens is decreased.

It is important that the novice in photography should learn to avoid this undesired effect of the

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properties of the lens. We shall explain in the following paragraphs how the depth of focus may be varied by adjusting the actual focussing, and stopping down the lens.



Fig. 2.—Photograph with Lens Focussed at “Infinity”.

PHOTOGRAPHING WITH “FOCUS AT INFINITY”

Fig. 2 shows us a picture of an office taken with the camera extended until it reaches the “Infinity” catch. (This point is usually indicated by the sign ∞ which, in mathematics, represents infinity). Focussed thus, and with the focal length used, the sharply defined part, as is seen in the

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illustration, only begins in the last third of the picture; the foreground is blurred.

The "Infinity" position must only be employed for pictures without foreground, in which the important parts are some distance away. For example, in photographs taken from a height.



Fig. 3.—Photograph with Lens Focussed on the Foreground (Near Objects).

EXPOSURE WITH LENS FOCUSED ON THE FOREGROUND

We cannot make things any better simply by focussing on the nearest objects in the foreground instead of at infinity (∞). This would result in the opposite effect, as in Fig. 3. By focussing

upon near objects the sharp portion is only brought more to the foreground. The foreground itself is then clearly defined ; from the middle onwards the sharpness noticeably diminishes, and the blurred appearance is more and more marked towards the background.

LENS FOCUSED ON NEAR OBJECTS

If a picture is required in which all the details, from the foreground to the background, are to be equally distinct, which means that the area of the sharp portion of our picture must be greatly extended, then the focus must first be attended to, and the depth of focus increased by stopping down the lens.

Since, as we have already shown, the depth of focus of a lens causes not only a point definitely focussed to be sharply defined, but also a very definite portion of the picture, focussing upon any particular object brings out sharply a certain portion of the picture both before and behind that point.

If, for instance, the part which is to be clearly defined begins at a distance of 15 feet from the camera, and extends to about 45 feet, and if the

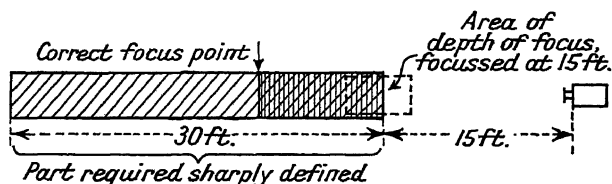


Fig. 4.

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Fig. 5.—Lens Focussed on Near Object and Stopped Down.

camera is focussed at the point 15 feet away, the depth of focus will be as shown in the diagram, Fig. 4.

As, however, the depth of focus extends both behind and in front of the point focussed, we must focus on a point farther away from the camera, somewhere within the first third of the portion which we wish to have sharply defined, and the lens must be stopped down. There is, however, no need to calculate this point, as it is only necessary to have the pointer half-way between 15 and 45 feet on the distance scale. Fig. 5 shows the same picture with the whole extent from foreground to background equally sharp.

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The instructions given above may be easily carried out with the help of the following tables, which are worked out for the focal lengths customary with cameras taking plates of $2\frac{1}{4} \times 3\frac{1}{4}$ and $4\frac{1}{4} \times 3\frac{1}{4}$ inches.

DEPTH OF FOCUS TABLE FOR FOCAL LENGTH
 $f = 4\frac{1}{4}$ inches

Focussed at (Feet)	Stop 4.5		Stop 6.3		Stop 8		Stop 11		Stop 16		Stop 23	
	From	To	From	To	From	To	From	To	From	To	From	To
∞	77	∞	56	∞	36	∞	28	∞	20	∞	14	∞
36	26	74	22	121	22	∞	16	∞	13	∞	10	∞
32	23	55	21	74	18	174	15	∞	12	∞	9	∞
26	20	38	18	47	16	74	13	∞	11	∞	9	∞
20	15	24	13	29	13	38	11	60	10	∞	8	∞
16	13	20	11	22	11	27	10	37	9	87	7	∞
12	11	15	10	17	10	19	9	23	8	35	6	112
10	9	11	8	11	8	12	7	14	6	19	5	30
6	6	7	5	7	5	8	5	8	5	8	4	11
4	4	5	4	5	4	5	4	5	4	6	3	7

DEPTH OF FOCUS TABLE FOR FOCAL LENGTH
 $f = 5\frac{1}{4}$ inches

Focussed at (Feet)	Stop 4.5		Stop 6.3		Stop 8		Stop 11		Stop 16		Stop 23	
	From	To	From	To	From	To	From	To	From	To	From	To
∞	128	∞	93	∞	64	∞	47	∞	33	∞	24	∞
64	42	128	38	192	32	∞	27	∞	24	∞	18	∞
48	35	77	32	96	27	160	24	∞	20	∞	16	∞
32	26	42	24	49	22	62	18	99	17	∞	12	∞
26	22	32	21	35	18	42	17	55	14	112	12	∞
19	20	23	16	24	14	27	14	32	12	45	11	96
16	14	18	14	19	12	21	11	24	11	31	9	48
13	12	14	11	14	10	15	10	18	9	21	9	27
9	9	10	9	10	8	11	8	12	7	13	6	16
6-7	6	7	6	7	6	7	6	8	5	8	5	8
4-5	4	5	4	5	4	5	3	5	3	5	3	5

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At infinity, the sharply defined portion of the picture, with focal length $4\frac{1}{4}$ inches and aperture $f6.3$ begins at a distance of 59.5 feet from the camera, whereas with the longer focal length of $5\frac{1}{4}$ inches, it only begins at a distance of 93 feet.

RULE: The greater the focal length, the farther away from the camera is the point at which the sharply defined portion of the picture begins.

When focussed upon an object 16 feet away, the depth of focus, using a lens with focal length $4\frac{1}{4}$ inches, extends only from $12\frac{1}{2}$ feet to $22\frac{1}{2}$ feet from the camera, i.e. only 10 feet in all. If, however, the lens is stopped down to $f11$, the depth of focus begins at $10\frac{3}{4}$ feet and extends to $37\frac{1}{2}$ feet, i.e. $26\frac{3}{4}$ feet in all.

RULE: Focussing upon the same point, the extent of the sharply defined portion may be increased by stopping down the lens, and in this case the increase is greater towards the background.

With the greater focal length of $5\frac{1}{4}$ inches, the area of sharpness not only begins at a greater distance from the camera, but is also much narrower from side to side. Focussed at 15 feet, and with aperture $f6.3$, it extends from 14 feet to $19\frac{1}{2}$ feet, that is to say, over a portion of a total depth of $5\frac{1}{2}$ feet, and with aperture $f11$, only those portions of the picture at a distance of from 12 to 25 feet from the camera will be sharply defined.

RULE: The farther from the camera the point focussed, the farther into the background will the

sharply defined portion extend, and with shorter focal lengths a greater area is obtained.

EXAMPLE :

Focal Length (Inches)	Focussed at (Feet)	Stop	Depth		Width (Feet)
			From (Feet)	To (Feet)	
$4\frac{1}{4}$	15	6.3	$12\frac{1}{2}$	$22\frac{1}{2}$	10
$4\frac{1}{4}$	30	6.3	21	75	54
$5\frac{1}{4}$	15	6.3	14	$19\frac{1}{2}$	$5\frac{1}{2}$
$5\frac{1}{4}$	30	6.3	$24\frac{1}{2}$	49	$24\frac{1}{2}$

LENGTH OF EXPOSURE

The length of exposure is one of the most difficult problems in photography. *A good negative can only be obtained when the amount of light necessary for a given subject has been able to act on the negative material during exposure.* It is impossible to choose a shutter-speed arbitrarily, or to give the same exposure for entirely different subjects.

To give the correct exposure is, however, not so difficult when we know the circumstances that must be taken into consideration. In determining the correct length of exposure, the following factors in particular play an important part :

1. The brightness of the light.
2. The brightness and colour of the subject.
3. Effective aperture (stop).
4. Sensitivity of the negative material.

But if an exposure meter is used, there is no need to rack one's brains over the many points which affect exposure. Any good exposure meter—and there are many upon the market—takes into account all the conditions of importance, and

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gives at once the correct length of exposure for any picture, at any particular aperture.

N.B.—When in doubt it is better to give a longer rather than a shorter exposure.

NEGATIVE MATERIAL

Films or plates are used as negative material. In calculating the necessary length of exposure, their degree of sensitivity to the action of light is of great importance. They may be divided into the following groups :

Normal speed.	. 250-350 H. & D. *
High speed . . .	400-650 „
Super speed . . .	650 „ and upwards

Super-speed negative material possesses the particular advantage that very short exposures can be given with it. It should be used, for example, when taking rapid sports subjects, and especially for exposures under unfavourable light conditions. Speed alone, however, is not the only criterion of good negative material. Quite apart from the fact that the various kinds have very different degrees of colour sensitivity (orthochromatism) (see p. 54 seq.), they differ fundamentally in their capacity to express variations of tone from black to lightest grey, on which subject, however, further comment would be outside the scope of this book. One very important quality,

* So called after the inventors of this system of measurement, Hurter and Driffeld. Some exposure meters are based upon the Scheiner system, in which normal speed = 14-17 ; high speed = 18-20, and super-speed 20 and upwards.

however, must be mentioned, and that is freedom from halation. With all subjects presenting strong contrasts of light and shade, only halation-free material (often called anti-halo) should be used (see p. 38).

METHOD OF MAKING EXPOSURE

There are two methods of making the exposure : either with the camera in the hand or with a tripod. The choice between the two cannot always depend on personal preference. It is not advisable to leave the tripod at home because it is such a nuisance to carry, or not to bother to set it up because, when we set out, we made up our minds only to use the camera in the hand.

Exposures with the hand camera necessitate holding the camera absolutely still whilst the exposure is being made, and this is only possible when the shutter speed is faster than $1/25$ th second. This rule should not be regarded lightly, since even with an exposure of $1/100$ th second the picture may be spoilt if the camera is jerked at the moment the picture is taken. One should not be misled by the word "Instantaneous" into taking a picture by hand when a large fraction of a second is required for the exposure (e.g. $1/10$ th, $1/5$ th, $1/2$ or 1 second) ; the result would certainly be blurred.

NOTE.—*For any photograph taken with the camera in the hand, the length of exposure should never exceed $1/25$ th second.*

A tripod should always be used, even for very

short exposures, when it is required to take a subject of a very limited area.

A further rule should be noted : Except where a special effect is particularly and deliberately sought, the camera should always be absolutely horizontal during exposure : it must not be tilted either up or down, or canted on one side (see pp. 31 and 32).

All the gadgets used when taking a photograph should be operated in a regular order. This not only makes the work easier, and makes unforeseen accidents less likely, but prevents anything being forgotten. The order followed in the following instructions has been chosen as likely to be the most serviceable. Every detail which has to be observed in making an exposure is summarized in this table. The instructions should be practised over and over again, until they become almost unconscious ; then they may be used in actual work.

INSTRUCTIONS FOR MAKING THE EXPOSURE

I. CAMERA HELD IN THE HAND

1. Pull down the base-board.
2. Pull the bellows out slowly, until the pointer is at " Infinity " (∞).
3. Ascertain what distance the subject is from the camera.
4. Set the pointer at that distance on the scale.
5. Regulate the stop.
6. Ascertain the length of exposure required.

7. Set the instantaneous shutter accordingly.

8. Hold the camera firmly against the chest with both hands, take the release between the first and middle fingers of the right hand, and, standing with the feet slightly apart, look at the picture in the finder. When ready, release the shutter by pressing slowly with the thumb, without jerking.

N.B.—An exposure made with the camera in the hand should not exceed 1/25th second.

9. (If using roll film) Turn the film round slowly to the next number. It is not advisable to wait until the camera is closed before turning the film round, as it may become slightly scratched.

10. Close the camera.

2. PLATE CAMERAS ON TRIPOD

1. Pull out tripod and fix it ; if wooden tripod, tighten all screws.

2. Pull out the base-board of the camera, and draw out the bellows until the pointer is at "Infinity" (∞).

3. Screw the camera with the base-board to the tripod screw. When setting the tripod care must be taken to have one of its legs in front, i.e. under the lens, and the other two at the back. It is only when the tripod is in this position that the photographer has sufficient freedom of movement, and the danger of jerking the camera is obviated.

4. Open the lens ; look at the subject on the ground glass with the lens at fullest aperture, and focus sharply, making use of a magnifying-glass

if necessary. When photographing buildings it is advisable to use a small water-level so that all vertical lines in the image may be adjusted until they are parallel with the edge of the ground glass.

5. Stop down until the foreground is of the required degree of sharpness.

6. Close the lens shutter.

7. With the right hand, and slight counter-pressure from the left, carefully remove the focussing screen, so that the plate-holder, also with slight counter-pressure with the fingers, may be inserted (plate towards the lens).

N.B.—Any movement of the camera or tripod leg alters the boundaries of the picture already focussed, and renders a fresh test with the focussing screen necessary.

8. Decide the length of exposure required, with the help of an exposure table or optical exposure meter.

GOLDEN RULE: *When in doubt, give a longer exposure, rather than a short one.*

9. Set the shutter to the correct speed.

10. Slowly pull the sheath of the plate-holder right out, keeping the holder itself in position by a gentle pressure with the left hand.

11. Expose slowly, not jerkily, with the metal release.

12. Close the plate-holder with the sheath, and take it out of the camera. When using a film pack, the paper tab must be slowly and evenly pulled out—never in a slanting direction—and torn off.

13. Put back the focussing screen.

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14. Unscrew the camera, bringing the lens and base-board into normal position, and then slide the bellows into the case, and shut the base-board.

15. Take down the tripod.

Like everything else in photography, the technique of exposure offers only too many opportunities for failure, and few amateurs make a technically faultless picture the first time. Unfortunately, instead of blaming their own ignorance and carelessness, they are only too apt to blame the camera or the negative material for their failures.

It happens not infrequently, especially if the exposure for some reason or other is made in a hurry or in a moment of excitement, that a particular button or gadget has not been pressed at the crucial moment. No photographer, however experienced, is absolutely proof against such accidents. In the following picture, not the

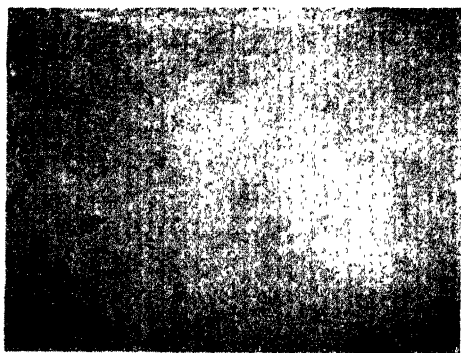


Fig. 6.—Plate never Exposed.

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slightest trace of any image is visible, the plate remaining perfectly blank and void when developed.

This may be due to one of the following causes :

1. The shutter failed to work. This may be, because :

- (a) The pressure on the release was insufficient.
- (b) The wire release was not screwed on tightly.
- (c) The shutter was out of order.

2. If the shutter was correctly operated, the photographer may have forgotten :

- (a) (When using plates or cut films) To pull out the sheath.
- (b) (When using a film pack) To remove the strip marked " O ", which shields the film from the light, before making the first exposure. Consequently the film window remained covered, although the slide had been pulled out.
- (c) (When using a film pack) To put the film pack correctly into the holder. It may have been inserted upside down.
- (d) (When using roll film) To put the film in correctly. With roll film, the film itself is on the inner, black side of the strip of covering paper. It can, therefore, only be exposed when the roll is so inserted that the black side is towards the lens. It is only when the film is in this position that the number is visible in the red window at the back of the camera, when the camera is closed.



Fig. 7. —Double Exposure.

Cause

1. (When using roll film) The film was not moved on after an exposure, or a previously exposed film was put into the camera.

2. (When using a film pack) Either the tab was not pulled round after making an exposure, or, as may sometimes happen, the wrong one was pulled, i.e. *not* the one bearing the lowest number.

3. (When using plates) The plate-holders have been mixed up, so that the same plate has been exposed twice.

To Avoid

One should form the habit of, immediately after the exposure :

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1. (When using roll film) Turning the film round until the next number appears in the red window. Exposed films should be kept apart from unexposed. They can easily be distinguished by the labels marked "exposed" and "unexposed".

2. (When using a film pack) Pulling out the last tab (i.e. the one facing the lens, and bearing the smallest number) slowly and evenly.

3. (When using plates) Keeping holders of exposed plates separate, or marking them in some way. It is also advisable, in order to help to distinguish holders containing exposed plates, to put them in the case upside down.



Fig. 8.—Negative Black all over.

Cause

1. The shutter was set to "Time", instead of "Instantaneous".

2. After focussing with the ground glass, the

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shutter was not closed, and light fell on the plate as soon as the sheath was withdrawn.

To Avoid

In both cases this fault was due to disregard of exposure rules. After focussing the subject and setting the stop, the lens should at once be closed, and then the holder inserted. The lens will remain closed until the shutter is set at the correct speed.

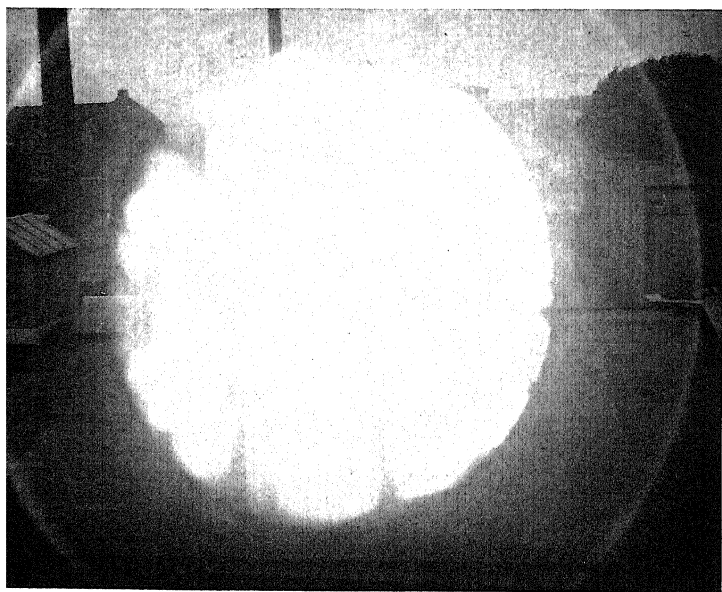


Fig. 9. —Premature Exposure due to Involuntary Opening of the Shutter.

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The possibility of making this mistake is increased if the camera is fitted with a shutter which does not have to be set before exposure can be made.

In roll film cameras the sensitive film behind the lens is not absolutely enclosed—the only protection there is against the light is that of the lens shutter. There is always a danger of making an involuntary exposure; it may happen if the shutter is accidentally touched, and opened, when the camera is closed. If the bellows are quite closed when this happens, a round black spot will appear in the centre of the picture, the size of the stop which was set when focussing.

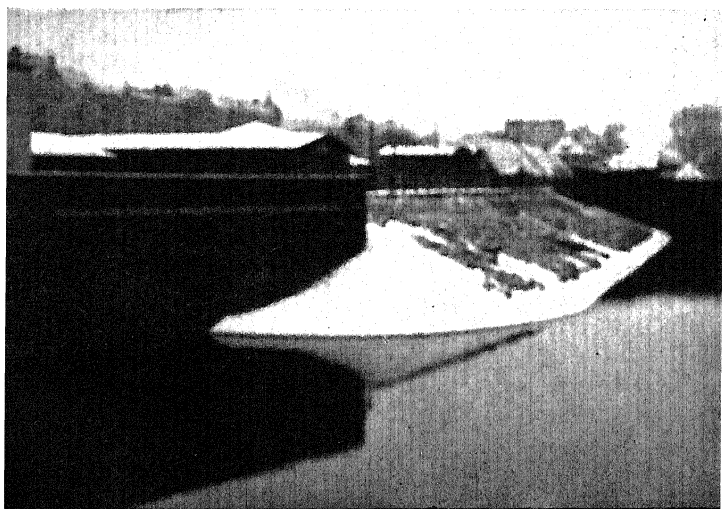


Fig. 10.—Picture Indistinct.

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An indistinct picture is blurred all over, and all the contours run softly into one another.

Cause

1. Distance incorrectly estimated, especially in the case of a hand exposure made without focussing on the ground-glass screen.

2. If the distance of the subject from the camera was correctly judged, and no mistake was made with the pointer and the scale when focussing, the distance scale fitted on the base-board was faulty.

3. In a roll-film camera, the film was not stretched tightly enough.

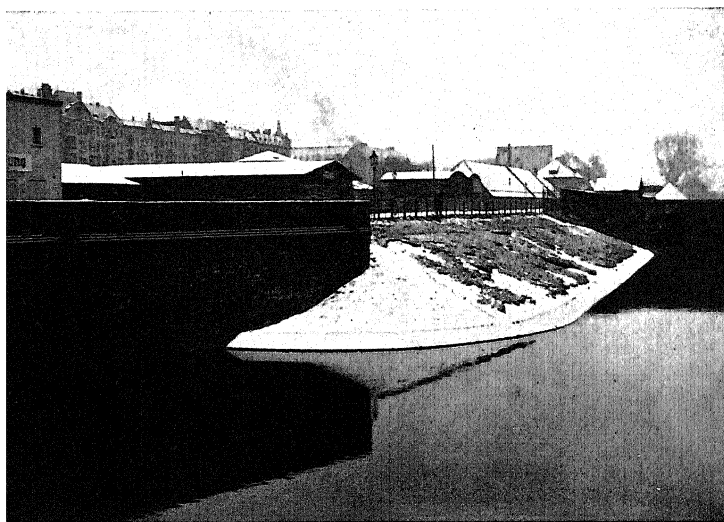


Fig. 11.—Picture Sharp.

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4. If the image was defined sharply enough on the focussing screen, the fault is due to so-called "plate-holder difference". If the picture appears reversed as in a mirror, the mistake is accentuated, because in this case the plane of the image is moved still farther back by the thickness of the glass.

5. The panel which supports the lens is insecure, and was pulled back when the bellows were extended.

A blurred picture may be due to several other causes, e.g. :

- (a) If the lens was dusty or scratched, or if there were raindrops, snowflakes, finger marks, etc., on it.
- (b) If, taking near objects (some 4 to 5 feet from the camera) with box cameras, the portrait attachment was forgotten.

To Avoid

1. It is better to gauge the distance by strides (stride = $2\frac{1}{2}$ feet) than simply to guess. A tape measure or foot rule is often extremely useful. Optical distance meters are very useful and reliable, though somewhat expensive.

2. Have the camera tested by an experienced mechanic.

3. (When using roll film) See that the paper strip runs evenly from the start, and is sufficiently taut between the two spools. It is advisable not

to turn the film right round to the next number after making an exposure, but only to the warning

.....5

dots5 and to bring the film round to the

.....5

number itself immediately before making the next exposure.

4. "Plate-holder difference" is caused by the fact that the sensitive material is not set in exactly the same plane as the focussing screen. This most frequently occurs in the case of holders bought separately, which were not made to fit the camera; or when a film-pack adapter is used. This can be put right by an expert.

5. The camera should be repaired by a camera mechanic. The lens should be examined before making an exposure and, if necessary, wiped with a soft cloth; dust is best removed by a soft brush, so that the sensitive surface of the lens may not be scratched.



Fig. 12.—Camera Moved.

This fault must not be confused with incorrect focussing. Here, what has actually happened is that the picture has been taken twice over on the same plate at the same exposure, because the camera was moved while the lens was still open.

Cause

1. The camera was moved as the shutter was released.
2. The sheath of the dark slide was not com-

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pletely withdrawn at the time of exposure, and was caught by the wind.

3. The tripod is too light, or is not steady enough.

To Avoid

1. Movement of the camera may have various causes. In the case of a hand exposure, it is usually due to holding the body and the camera incorrectly. The photographer should make a



Fig. 13.

Using a Brilliant Finder. Using a Direct Finder.
Wrong Position. Correct Position. Wrong Position. Correct Position.

habit of standing in the following position: feet slightly apart, camera held in both hands, elbows pressed close to the sides, and camera held close against the cheek if a direct view-finder is used, or the chest if the camera has a brilliant view-finder. The release is between the first and third fingers of the right hand. Hold the breath, whilst slowly (and not jerkily) operating the metal release. The shutter should not be released by pressing the lever with the hand.

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2. Never attempt to make a time exposure with the camera in the hand, but always use a tripod for exposures longer than $1/25$ th second (i.e. $1/10$ th, $1/5$ th, etc.). If necessary, any firm support can be used instead of a tripod. A so-called chain-stand is often very useful; it takes up no room in the pocket, and enables exposures of $1/10$ th second and longer to be made without movement of the camera. The same effect may be obtained with a strong piece of string, which



Fig. 14.—Using the Chain-stand.

must be kept taut by being held down by the foot. In both cases care must be taken to avoid pulling the camera slightly to one side.

3. Always choose a steady tripod, and when buying it, see that not only *your own* camera rests firmly upon it, but that both camera and tripod are not affected by a slight touch. An unsteady tripod is worse than none at all. Tubular tripods should frequently be cleaned to keep them free from dust and sand, and occasionally greased, to ensure their retaining their stability.



Fig. 15.—Blurred in Places.

Cause

1. The subject moved suddenly during the exposure.
2. The speed of the shutter was too slow compared with the rapidity with which the subject moved.
3. Imperfections in the lens.
4. If the centre of the picture is sharp, but the edges and corners indistinct, the lens is too small for the plate, so that if the lens is moved up or down, the whole of the picture cannot be

sharply defined. In this case the effect of vignetting may be produced to some extent.

To Avoid

1. In all cases where the subject is likely to move at the wrong moment, e.g. with children, animals and nervous people, it is better to use the instantaneous speeds. In the case of subjects which may be moved by a light wind, e.g. leaves and flowers, wait until they are still before giving long instantaneous or time exposures.

2. When taking moving objects the following rules generally apply :

(a) Short (rapid) exposures should be given when—

1. The subject is close to the camera.
2. The lens is of considerable focal length.
3. When the subject is moving across the camera.

(b) Longer (slower) exposures may be used for—

1. Subjects farther away.
2. Lens of comparatively short focal length.
3. Movement at an acute angle with, or directly approaching, the camera.

It has been calculated that the shortest exposures for moving objects, using a lens with a focal length between $4\frac{3}{4}$ and 6 inches, are :

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Subject.	Approaching Camera.			Across Camera.		
	15 feet.	16-30 feet.	30-∞.	15 feet.	16-30 feet.	30-∞.
People and horses } at walking pace Children quietly } playing . . . }	1/50	1/40	1/25	1/100	1/75	1/40
Running, or trot- } ting horses . Children playing, } with consider- able movement }	1/100	1/75	1/50	1/250	1/150	1/75
Cyclists . . . } Horses at gallop } Buses or trams . }	1/250	1/150	1/100	1/500	1/250	1/150
Sports subjects . } Motor-cars, aero- } planes, motor boats . . . }	1/500	1/250	1/200	1/1,000	1/600	1/400

3. Imperfections may be due to stresses in the glass, or due to incorrect fitting of the portions of the lens.

4. Here, considerable stopping down of the lens will usually help.

A picture may be blurred in places owing to the nature of the negative material. When film, either as roll film or film pack is used in a large size, it is difficult to make sure that it lies quite flat. In such a case hollows may be formed, which may cause the picture to be unsharp in places. Lastly, be careful not to insert the plate the wrong way round.

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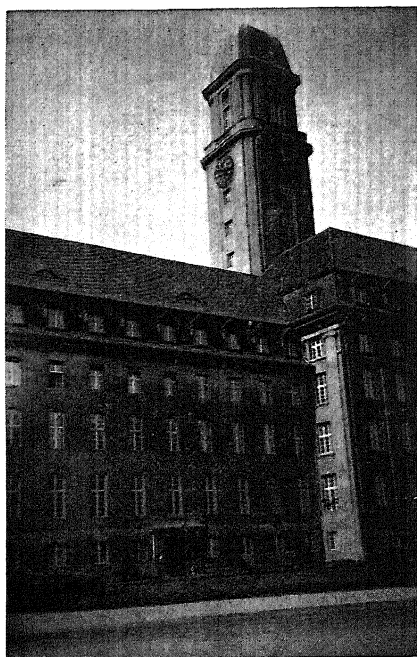


Fig. 16.—Vertical Lines leaning backwards,
the Camera having been Tilted Back.

Cause

This fault is not due to a defect in the lens. It is much more likely that the camera was not held perfectly upright and parallel to the vertical lines in the subject, so that the focussing screen was tilted. There is a great temptation to hold the camera in this way when we wish to get more of the upper portion of the subject in the picture, or when taking a photograph from a high stand-point, in order to get more foreground into the picture.



Fig. 17.—Vertical Lines converging towards the Bottom, owing to Camera having been Tilted Forward.

If the camera is tilted backwards, the vertical lines run together at the top (Figs. 16 and 16a).

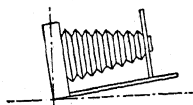


Fig. 16a.

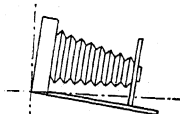


Fig. 17a.

If the camera is tilted forwards, the vertical lines run together at the bottom (Figs. 17 and 17a).

To Avoid

Use a water or spirit-level when holding the camera in the hand, and take care that the vertical lines appearing at the edge of the view-finder are parallel with the edge of the finder (either brilliant or direct). The use of a magnifier is often of advantage for this purpose.

When using the camera on a tripod, it is well to have a small water or spirit-level to rest on the base, and to set up the camera accordingly.

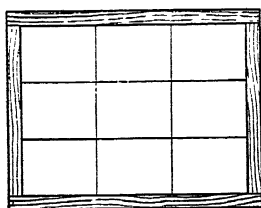


Fig. 18.

If the camera has a ground-glass focussing screen, lines may be drawn upon the etched side of it with a pencil (or with Chinese ink) as in Fig. 18. This provides an admirable means for finding out whether the vertical lines of the subject will be correctly reproduced in the photograph.

The following means may be used to determine the extent of the picture.

(a) In order to get more of the upper part of the subject on to the negative, or to shorten an empty foreground, extend the tripod, and if this has been done to the fullest extent, raise the lens

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by means of the rising front. If this is insufficient, the camera must be moved farther back.

(b) If, on the other hand, the foreground is to take a more prominent part in the picture, or the upper edge of the picture is to be brought lower down, shorten the tripod or drop the lens.



Fig. 19. —Unnatural Effect caused by having the Camera too high.

An unnatural picture will usually result if the camera is much higher or lower than the level of the eye. It is usually necessary to hold the camera low down when looking at the image in the brilliant finder. Portraits taken in this way

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often show the neck too long, and the lower part of the face too strongly emphasised. If the camera was too high the fault will be reversed ; the neck will appear too short and the forehead too deep.

To get a natural portrait, and to preserve the correct proportions, see that the axis of the lens



Fig. 20.—Taken with the Camera too Low Down.



Fig. 21.—Taken from Normal Position.

is on a level with the middle of the face, or better still, the eyes, when the exposure is made.

To secure a proper perspective both the height from which the picture is taken and the distance of the subject from the camera must be taken into account.

The picture shown in Fig. 22 is not due to any fault in the lens ; such a result may be obtained with the best lens made as easily as with an inexpensive one, if the picture is taken with the camera too near the subject.

There is a tendency to make the subject too large, when taking portraits. Consequently, the features closest to the camera, e.g. nose and ears,



Fig. 22. —Exaggerated Perspective.

and—in the case of seated figures—knees and hands, or, with groups, the front row, are too large, while the parts farther away appear, on the other hand, considerably shortened, or reduced in size. To avoid such distortion have the camera at least 4 feet from the subject ; for half-length portraits and complete figures, the distance should not be less than 9 feet.

If a large head is wished for, it is best to follow the rule given above, secure a perfect negative, and afterwards enlarge it to any size desired.

Amateurs with some experience may perhaps take advantage of one of the following methods of getting out of the difficulty. If they possess one of the modern double anastigmat lenses, of which both halves are symmetrical, they can secure a greater focal length by using one half of the lens by itself. If their lens is of the unsymmetrical type, they may use an attachment which fits over, or screws into, the front of the existing lens, and increases the focal length.

But in both these cases, the camera must be capable of more than the normally used extension. By one of the above expedients, and using a camera with double extension, it is usually possible to get a portrait double the size of one obtainable from the same position with the normal lens.

N.B.—When a lens of greater focal length is used, the time of exposure must be increased, because of the law that the brightness of the light, and consequently, its capacity to affect the sensitive emulsion, decreases as the square of the distance. Therefore, in all these cases, the exposure must not be twice but four times as long as in photographs taken at the normal extension.

HALATION

Cause

Whenever the subject of a photograph contains strong light contrasts, the glass of the plate causes reflection of the light rays.

This phenomenon, which, although quite natural,

spoil the picture, is known as "halation". It is not so noticeable when films are used, owing to the greater thinness of the celluloid layer, but film of itself is not halation-free.

To Avoid

Use anti-halo plates and films, which obviate this phenomenon, or reduce it to a minimum by inserting a red or brown anti-halo layer between the emulsion and its support (glass or celluloid), or by means of a black or red backing.

For all photographs in the open, where the sky, or even only a portion of it (as with landscapes with

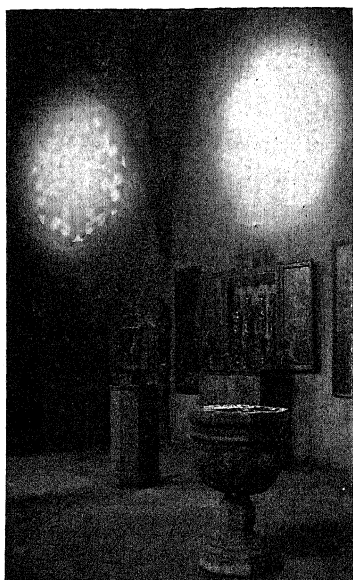


Fig. 23.—Photograph taken on Ordinary Plate.

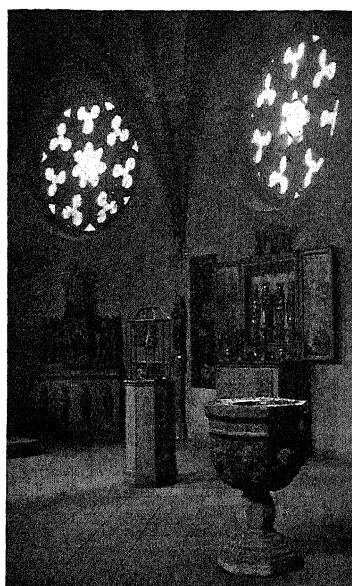


Fig. 24.—Taken on Anti-halo Plate.

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trees), comes into the picture, it is essential to use, anti-halo material. And this is true of all pictures taken against the light, whether out of doors or indoors against a window; also, for burning lights, people in light clothes against a dark background, and vice versa; in short, in every case where there is a strong contrast of light and dark.



Fig. 25. —Part of Picture Obliterated.

Cause

When making the exposure the amateur looked into the lens from one side, perhaps to see whether the shutter was working properly, thus bringing a part of his head into the path of the light rays

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making the picture. As the camera was focussed upon a distant point, this portion of it is, of course, blurred. A similar fault may also be caused by the hand when moving the shutter lever with the finger, or by people suddenly going past.

“VIGNETTING” DUE TO SAGGING BELLOWS

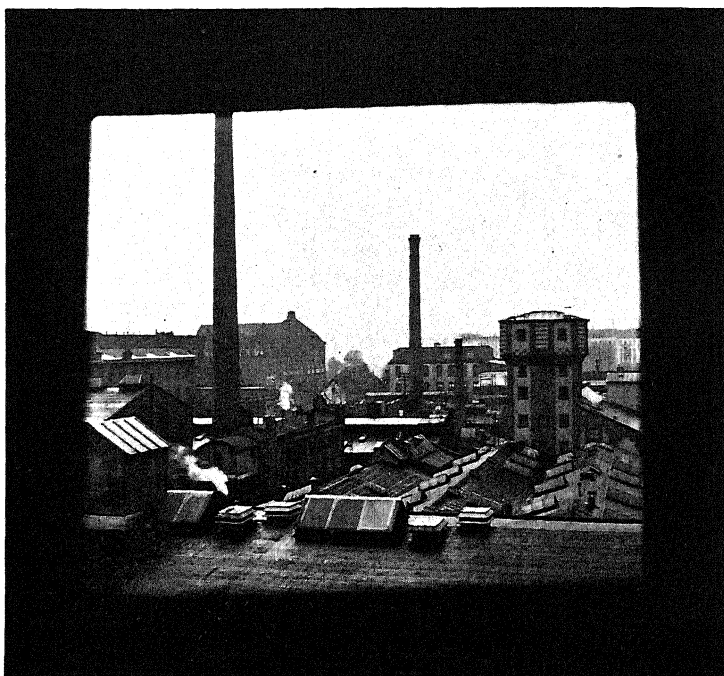


Fig. 26.—“Vignetting” due to Sagging Bellows.

Cause

1. Cameras with double extension have a corresponding length of bellows. When making an ordi-

nary exposure, necessitating only the normal extension, it often happens that the bellows, having lost their rigidity, hang down, and may thus make a complete frame round the picture, which appears on the negative with a blank border. Also, when using the camera in the hand, there is a possibility that the steadying hand may press against the bellows, causing a portion of the picture to be obliterated.

2. It may also happen that leather bellows, either because they have got damp, or have been unused for a long time, or some other similar reason, stick in the folds at the wide end, and thus diminish the size of the picture.

To Avoid

1. When making exposures requiring normal bellows extension with a camera with double extension, always see that the unused portion is made fast to the camera front. Usually a wire ring is attached for this purpose, but, if not, one can easily be fitted.

2. Before making an exposure, be quite sure the folds of the bellows have been completely opened out.

Vignetting of the picture may also be due to other causes.

1. When the lens is raised or lowered, its optical axis is displaced, so that in certain circumstances, particularly at the larger apertures, some of the light rays received by the plate are out-

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side the field of the picture, and consequently the negative is acted upon insufficiently, or not at all (Fig. 27).

2. When a wide-angle lens is used, the light rays fall upon the plate at such an angle that a similar effect may be produced (Fig. 28). To

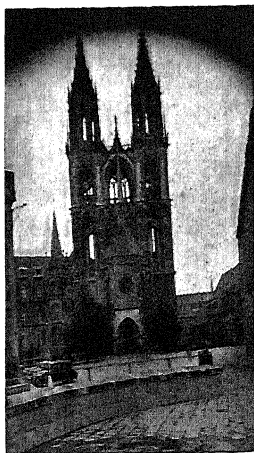


Fig. 27.—Top of Picture cut off because the Lens has been raised too much.

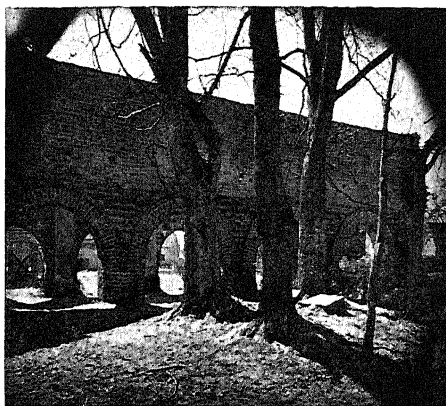


Fig. 28.—Part of Picture cut off by use of a Wide-angle Lens.

avoid this, the lens should be stopped down to $f12.5$ at least.

3. When buying a yellow filter, care should be taken to see that it is not smaller than the lens opening; if it is, part of the picture will be cut out when it is used.

4. When taking pictures against the light a shade should be used to prevent the reflecting action of rays falling obliquely into the lens.

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Such shades may be made out of a tube of thin card, in which case care should be taken that it is not so long that it produces a vignetting effect. The length should normally not be more than half or three-quarters of the diameter of the lens. Perhaps the simplest plan is to buy one of the "lens hoods" upon the market.

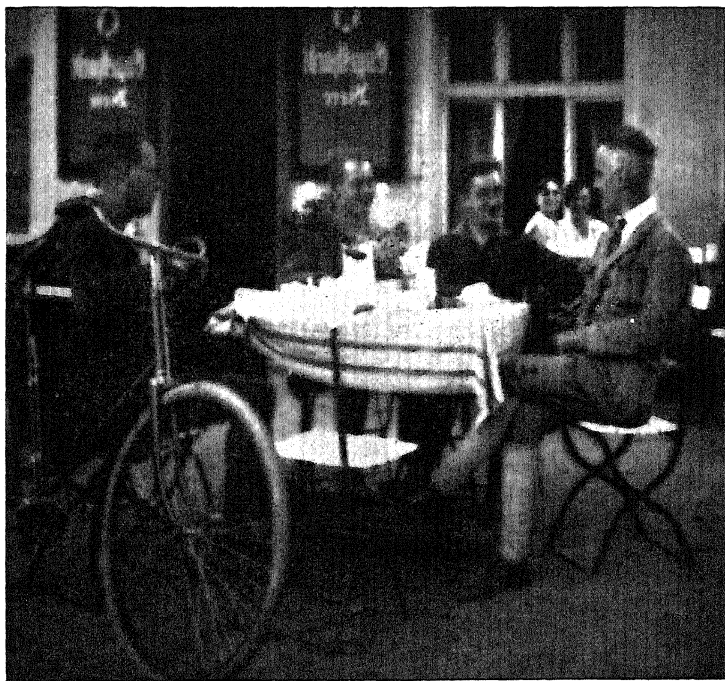


Fig. 29.—Image Reversed.

Cause

This may be due to plates or flat films being inserted in the holder back to front. Because

the plane of the picture is put farther back by the amount of the thickness of the glass or celluloid, the picture will be blurred, however sharply it may have been focussed. This will happen particularly at wide apertures.

To Avoid

The negative should always be inserted with the glass side to the back of the holder. This side may be recognized by the reflection of the red dark-room lamp—the coated side is always dull. One way of making sure is to breathe on the plate; the warm moisture in the breath will only be noticeable on the glass side. If, while traveling, for example, one has to insert the negative in the dark, it should be remembered that in the original package the plates are always put face to face (coated sides together). A corner of the negative may be delicately touched with a dry finger when the glass side will be recognized by its cold and polished surface.

Cause

This undesirable and annoying phenomenon may destroy all one's hopes of obtaining a pleasing result. It occurs especially when film packs are used, and is generally due to individual tabs having been pulled out too quickly. The presence of dust or fine sand in the adapter or in the camera may be a contributing cause.

With plate-holders a slight bend or kink in the sheath may cause a similar fault.

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Fig. 30. — "Telegraph Wires".

With roll film it is usually caused by rubbing when the film is wound, especially if this is done when the camera is completely closed.

To Avoid

The films should always be pulled round slowly and the tab pulled straight. The inside of the camera and plate and film-pack holders should be frequently dusted thoroughly, especially after having been used at the seaside, as fine sand blown by the wind will penetrate the smallest joints and chinks. Metal holders should be carefully packed to avoid pressure, because, apart from the danger of breaking plates, they may

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become slightly buckled, giving rise to scratches on the sensitive material.



Fig. 31. —Fog Marks (in Roll Film).

Cause

The black-and-red protective paper was not wound tightly enough and, when the film was taken out, light got in at the edges.

To Avoid

Great care is necessary when inserting the roll of film. The beginning of the paper strip must

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be put squarely through the slit in the spool, so that when wound the strip rolls evenly and flat between the two flanges. When taking out the film, take care not to press the finger on the paper strip, and so cause the wound-up spool to spring loose.

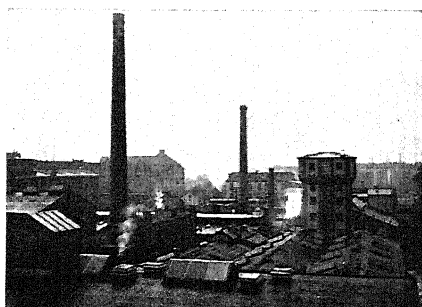


Fig. 32.—Spots of Fog due to Defect in Bellows.

Cause

The bellows are not light-tight.

To Avoid

Defects in the bellows may be due to a number of causes. To test the light-tightness of a camera, take off the focussing screen frame, or the back of the camera, put a black focussing cloth over the head, and turn the camera, with the lens closed, towards the sun. Any defect, however small, can then be detected in a few moments. If a hole is found in the bellows it may be mended by sticking over it a piece of black calico or

sticking plaster. In order to preserve the bellows, they may be occasionally greased with oil of rosin, particularly at the defective places, so that the pliability of the leather is maintained during the constant stretching and folding of the bellows.

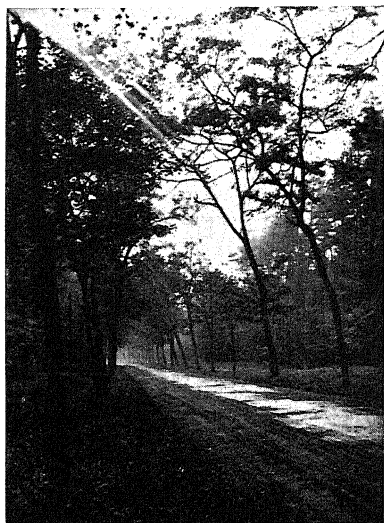


Fig. 33.—Fog due to Plate-holder or Film-pack Adapter not being Light-tight.

Metal plate-holders, after long use, and if not handled with sufficient care, are a frequent cause of failure. One very common such failure is due to light rays entering at the corner of the picture. This is caused by defective spots, which have arisen through rust, etc. To protect oneself against such mishaps, it is advisable to keep

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metal plate and film-pack adapters free from moisture, and to wipe them occasionally inside and out with a slightly greasy cloth.

Light may, however, be getting in through a worn velvet light trap in the plate-holder, back of camera, or film pack.

If the pile of the velvet has become flattened, it may usually be restored by being held in steam



Fig. 34.—Fog entering by the Velvet Strip of the Film Pack.

for a few minutes. Any moisture which is deposited on the holder during this operation must be carefully wiped away, to prevent the formation of rust. In order to preserve the velvet strip, the dark slides and ground-glass focussing screen may be kept withdrawn when not in use. To avoid light entering by the velvet light-trap of the film pack, take care that the tab is not pulled out beyond the point marked.

Lastly, light may also have entered because, after the exposure was made, one edge of the

sheath was put back into the groove first, thus flattening the pile of the velvet on the other side, and allowing the light to enter. Before pushing in the slide, put it carefully into the proper grooves.

EXPOSURES BY ARTIFICIAL LIGHT

FLASHLIGHT AND ELECTRIC LAMPS

When taking a picture indoors take care that there are no reflecting surfaces or objects, such as highly polished furniture, pictures under glass, uncurtained windows, glass doors in cupboards, etc., behind the person being taken. Anything of this nature, when illuminated by the lamp, will give a reflection which may be visible in the picture, as is seen in Fig. 35.

In a case where the photographer himself wishes to appear in the picture—as may often be the case with groups—several seconds must elapse after the setting of the shutter before the operator can be in his place. In the case of the exposure illustrated in Fig. 36, the general lighting of the room was so bright that it acted on the negative material before the flash was made. The book-case against the wall behind, therefore, clearly shows through the portrait. This does not mean that for flashlight exposures the room should be in darkness. This is very undesirable, as, owing to the sudden blinding flash, the faces of people

Fig. 35.—The
Lamp is Reflected
in the Mirror.



Fig. 36.—Preme-
ature Exposure
due to too Bright
Lighting of the
Room.

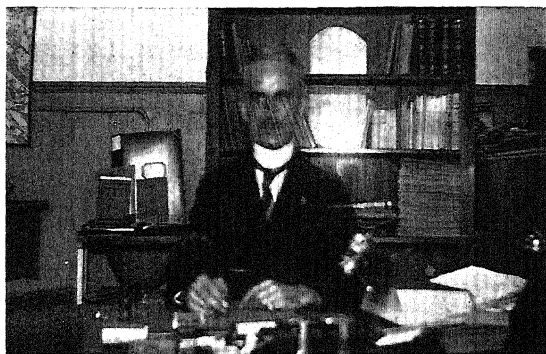
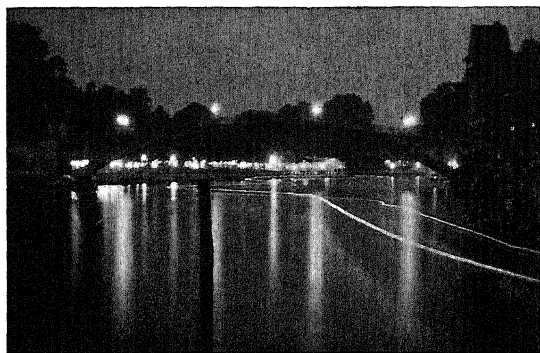


Fig. 37.—Lights of
Boat leave White
Streaks.



in the picture are apt to show an alarmed and unnatural expression. A bright light in the room, however, always calls for great care. In this picture, too, the reflection of the flashlight appears in the mirror on the bookcase.

Even outdoor pictures, when taken at night, require special care whenever a lighted vehicle comes into the field. In such cases the shutter must be closed while the vehicle is passing. It will suffice if the hand, the hat, or any other suitable object is held in front of the open lens. If this is not done, the line in which the lights were moving will appear in the picture as a white streak. In Fig. 37 the track of a steamer is clearly discernible, although there is no trace whatever of the steamer itself.



Fig. 38. —Pinholes.

Cause

These clear spots on the negative are not due to faulty manufacture in this case. They are solely due to fine particles of dust which settled on the sensitive layer during exposure, thus preventing the access of the light rays. In plate-holders, fine splinters of glass, scratched-off enamel, or loosened rust may also be the cause.

To Avoid

To prevent this mishap, it is advisable to dust the inside of the camera, particularly the folds of the bellows, the plate-holders, and their velvet light-tight strips, frequently and thoroughly with a brush. The formation of rust on the inside of holders can be prevented by frequently rubbing with a slightly greasy rag. To make sure that there are no particles of glass or enamel in the holders, these may be lightly tapped with the hand, holding them sideways.

It is not wise to dust the plates with a brush or the palm of the hand, as the electricity thus generated will all too easily attract particles of dust. Plates made under modern conditions are supplied absolutely free from dust.

A FEW WORDS ABOUT YELLOW FILTERS

Practically every amateur who has taken a landscape has noticed that the beautiful clouds which he saw in the sky did not appear in the negative. In the print there appears in their place a chalky white expanse, and all the tone value is lost.

The reason for this remarkable phenomenon is to be found in the natural property of photographic negative material, the light-sensitive component of which—silver bromide—is *sensitive only to blue and violet rays*. A normal silver bromide dry plate, such as is sold under the description “extra rapid” or “ultra rapid”, cannot, therefore, reproduce the colours in their true degree of brightness compared with one another.

Blue and violet appear the same as white; yellow and green are too dark, and red looks black. Thus, contrary to the impression received by the eye, yellow appears to be the brightest colour, green a middle tone, and violet-blue darker than these (see Figs. 39 and 40).

A truer picture may be obtained by the use of a colour-sensitive (orthochromatic) negative material. In this material the emulsion is rendered sensitive also to yellow and green rays, by means of certain dyes. All plates and films of this type are, however, extremely sensitive to blue, so that



Fig. 39.—Exposure with usual Extra-rapid Plate.



Fig. 40.—Exposure on Orthochromatic Plate with Yellow Filter.

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negatives made with it differ only slightly from those made on ordinary normal material, and even here, blue and green do not possess the true brightness of these colours.

To obtain a correct reproduction of tone values, the excessive blue sensitivity must be corrected,

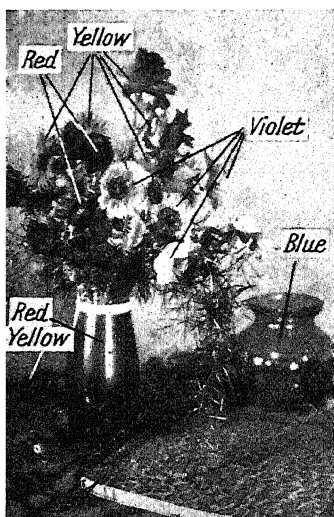


Fig. 41.—Exposure with usual Extra-rapid Plate.

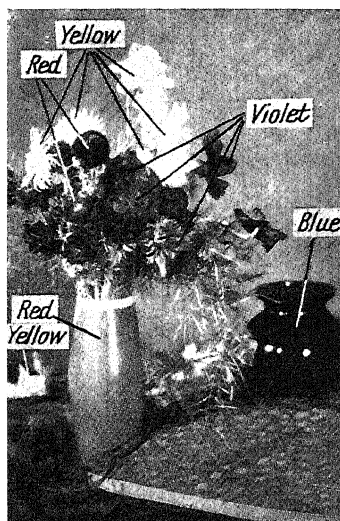


Fig. 42.—Exposure on Orthochromatic Plate with Yellow Filter.

and this is done by putting a slide of yellow glass or yellow filter in front of the lens. In penetrating this filter, the blue rays are weakened, while the yellow and green pass through without hindrance, and have sufficient time to act on the negative emulsion, without an over-exposure to the blue rays.

Yellow filters are made in three degrees of

strength: light, medium and dark. For general use, especially for summer landscape work, by the sea, or in the mountains, a light filter should always be employed in preference to a dark one. A dark filter generally goes too far in the required direction, thus rendering a blue sky too dark, and making light summer clouds look like thunder clouds. For ordinary purposes the medium filters give successful results, while for portraiture a light filter is more appropriate. A yellow filter should always be used when taking snow scenes.

When using yellow filters, it should be borne in mind that a longer exposure is necessary. The increase is not entirely dependent on the strength of the filter; it is therefore quite wrong to determine the increase of exposure by the description often applied to the filter of "equal" or "double" exposure, etc. It depends chiefly on the degree of colour-sensitiveness of the negative material. A great deal of confusion exists in people's minds on the subject of colour-sensitiveness, and the makers of the various exposure meters usually give useful hints on this matter.

Lastly, it should be noted that a yellow filter cannot be regarded as a universal means for obtaining correct colour tone rendering, but that colour-sensitive material is always necessary. No improvement whatever can be obtained when ordinary material is used.

THE NEGATIVE

AFTER exposure, the negative material still retains its original sensitiveness to light. Any further process which it undergoes must, therefore, be carried out with the protection of red light only, or, in the case of panchromatic emulsions, in complete darkness. Looking at the film or plate, by this light, we can see no trace whatever of the image ; the negative material retains its pale yellow colour, and is apparently unchanged, and indistinguishable from unexposed material. The explanation of this is based on certain laws of photography, which must be understood by every photographer who wishes to do his own developing.

The foundation of photography rests on physical and chemical processes which begin when the exposure is made, during which the image passing through the lens is transferred to the light-sensitive silver bromide emulsion on the plate or film. This transference of the image impression occurs in such a way that the silver bromide contained in the emulsion is split up into its component parts. But this process is imperceptible to the eye, and the image is still hidden in the emulsion layer—it is “latent”, i.e. invisible. In the

“ developer ”, by means of appropriate chemical solvents, the silver atoms which have been freed from the silver bromide are converted into black metallic silver, the image being thus “ developed ”. A further surprise then awaits us: what in the original was white or light in colour is now black or grey, and the dark portions appear light and transparent. The values of light and shade are completely reversed, and the plate or film is called a “ negative ”.

After this simple technical study of the chemical processes which have to do with the making of a photographic picture, we will go more closely into the details of this part of our work.

DEVELOPMENT TIME

When the exposed plate or film is placed in the developing bath, it is not changed immediately; the effect of the developing process only begins to be visible after a time. Those portions of the emulsion on which the light acted most strongly, i.e. all light and white parts of the original subject, begin slowly to blacken—these are the “ high lights ” of the negative. The longer the developing process continues, the deeper the black becomes, and the clearer the outlines of the picture. As the blacks become denser, if the exposure was fairly correct, the middle, or half-tones, come out, in gradation from lightest to darkest grey. These must be well developed, as they are very important in making a negative of harmonious gradation.

When the picture has appeared, the negative is taken carefully out of the developing bath, and held by the edges between finger and thumb over the dish, against the red light, so that we can look through it. This examination should last only a few seconds, or the negative may become slightly fogged owing to the nearness of the light. The object of this examination is to determine how far the covering of the dark portions (high lights) has proceeded, and how far the dark portions of the original, the so-called " shadows " of the negative, have come out. When we look through the negative the shadows appear more or less transparent, and, if the exposure was correct and development is complete, these transparent portions should show a fine degree of detail. If no detail appears in the shadows, whilst the high lights are absolutely opaque and the half tones well brought out, it is no use developing the negative any longer. Very often the exposure has been too short for the shadows, and further development would make the contrasts too harsh, thus giving the whole negative a hard appearance.

This brings us to the important question : *When is a negative fully developed?* Examination by transmitted light is the best method of telling when to stop developing. With a normal negative, i.e. one that has been correctly exposed, development should cease when the grey half-tones, as well as the shadows (the lightest portions of the negative), show up well when look-

ing through the negative, and the most heavily covered portions, the high lights, appear a little stronger than they should be in the finished negative. In general it is better to develop a little too long than not long enough, for the negative loses strength noticeably in the subsequent fixing bath. Correctly exposed negatives can be developed in about 5 minutes with most of the usual developers.

FIXING

The negative is not yet ready. It still contains in the emulsion a considerable quantity of silver bromide, which is not necessary for the formation of the picture, and has not been affected by exposure or darkened by development. This surplus silver bromide still preserves its original cream colour, and this is the reason for the vigorous appearance of the negative. It is, besides, still sensitive to light, and before the negative can be brought into strong light, the surplus bromide must be removed from the emulsion. This is done by immersing the negative in a fixing bath, in which the unchanged silver bromide is eliminated, while the black metallic silver remains. It is for this reason that negatives which have been taken too soon out of the developing bath appear thin and weak when we look through them, whereas correctly developed negatives do not appear to lose much of their strength.

Although the operation is attractive and simple in itself, a certain amount of practice and skill

are necessary before we can carry out the whole process in such a way that the resulting negative is as good as it should be. For this reason the novice will do well at first to have his photographs processed by his dealer. When, after a time, the results show a sufficient mastery of technique, the point has been reached when he may safely begin to develop for himself.

Doing one's own developing affords an excellent opportunity of obtaining a thorough insight into the connection of the various photographic processes, and the amateur who undertakes it will soon notice an improvement in all his photographic activities. There are one or two conditions in regard to the negative process which must be observed by one who wishes to turn out really good work.

METHOD AND APPARATUS

1. *The Darkroom.* This is the first consideration in carrying out the processing of negatives, and any room which is not too small, and can be darkened so that all light is excluded, will answer the purpose. Whether the darkness is sufficient can easily be determined if one remains in the room, when completely darkened, for about 5 or 10 minutes, because, only after this length of time can the eye discern any light which may be coming in. If the complete exclusion of light presents any difficulties, it is better to wait until night, when an ordinary curtain will usually suffice

to exclude all the light from outside. The room chosen should always be one provided with running water, a bathroom, a kitchen or something of the sort.

2. *Darkroom Lamp.* As the loading of plates may only be done by red light, so development has to be carried out also by red light. Whether an electric bulb, candle, or oil lamp is used, makes no difference. But it is important that the red glass used should be a ruby glass tested spectroscopically in regard to its suitability for photographic purposes; better still, one of the darkroom filters on the market, but never an ordinary piece of red glass.

3. *Three dishes*, of which two at least must be the same size as the plate or film, preferably of porcelain for development, and one glass dish for fixing. It is best to have this last dish big enough to take two or four plates side by side. For fixing negatives, a so-called "fixing trough" is recommended, but the solution must then be frequently stirred so that the negative will be evenly fixed all over.

If there is no running water in the darkroom, a medium-sized bowl or pail of water can be used for rinsing the negative.

4. *A bath for washing the plates.*

5. *A measuring-glass* for preparation of the developing solution.

6. *A drying rack* to take the plates, or several wooden clips for hanging up films.

7. *A bottle of concentrated developing solution.* The various developers on the market have differ-

ent properties, and may be divided into two classes, rapid and slow.

The rapid developers act very speedily, and bring out the whole picture quickly; there is, therefore, no time, especially in the case of an over-exposure, to correct any mistakes. Their use requires a good deal of practice, and the beginner had better not attempt to use them.

The slow developers permit of the formation of the picture in its various parts—high lights, half-tones and shadows—being more readily observed, and enable correction of exposure errors to be made. Of this group the best one for the beginner to use is Glycin, which can be obtained in concentrated form and has the especial advantage of working extremely cleanly and producing negatives of good quality and excellent gradation.

8. 1 *tin* of "*acid fixing salt*" which is to be dissolved in the quantity of water indicated on the package, at room temperature, and poured into a bottle.

Finally, the following items should be in every darkroom :

1. A small thermometer, to indicate the temperature of the solutions.
2. A watch or clock with a clear second-hand.
3. Two hand-towels, and a cloth to wipe up any solutions which may splash over.

The process of development may be carried out by several methods, which, if followed correctly, all lead to the same result. The beginner should,

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preferably, keep to a tested method of working, such as the one given below, which will ensure his obtaining good results.

GOLDEN RULES FOR DARKROOM WORK

The table, as well as all the utensils used, must be kept perfectly clean.

Each dish must be kept for the purpose for which it was first used, as the admixture of even a small trace of another bath may produce unfortunate results. Corks of fixing solution and developer bottles should not be interchanged.

Apart from lack of patience, the greatest enemy in the darkroom is the fixing bath. The dish used for this solution should be kept on the farthest corner of the table, or better still, on another table, or chair. The negative must be laid in the fixing bath carefully to prevent any fixing solution splashing into the other dishes. If the fingers are dipped in the fixing bath, they must be rinsed clean and dried immediately (extra towel!) before coming into contact with the developer.

THE ABC OF THE ART OF DEVELOPMENT

I. Exposure and development are interdependent; therefore the development should always be suited to the degree of exposure.

2. According to the length of exposure, the negative will be of one of the three following types: hard—normal (harmonious)—flat.

(a) *A hard negative* is always due to too short an exposure or too cold a developer. The shadows are transparent and glassy, and show no detail (Fig. 43). The half-tones are, in part, missing, and in their absence the high lights stand out harshly; the high lights themselves are generally too well covered, and show an even, dense black, giving too much contrast. *Under-exposure requires a very weak developing solution and temperature of at least 68° F.*

(b) *A flat negative* is the result of too long an exposure, or the use of too warm a developer. The shadows in this case are well defined, but are too strong; the high lights, on the contrary, are relatively insufficiently covered, and the half-tones will appear the same as the high lights (Fig. 44). Every portion seems to show almost the same density, so that there is not the necessary contrast between light and shade. The whole negative is—according to the degree of over-exposure—covered more or less heavily by a grey veil, which makes it look weak and all the same colour. *Over-exposed negatives require a strong, only slightly diluted developer at a low temperature, and the addition of 10 per cent. potassium bromide solution. They must be developed until they are quite black and opaque.* Subsequent treatment with Farmer's Reducer will give a serviceable negative.

(c) *A normal negative* is between the two and

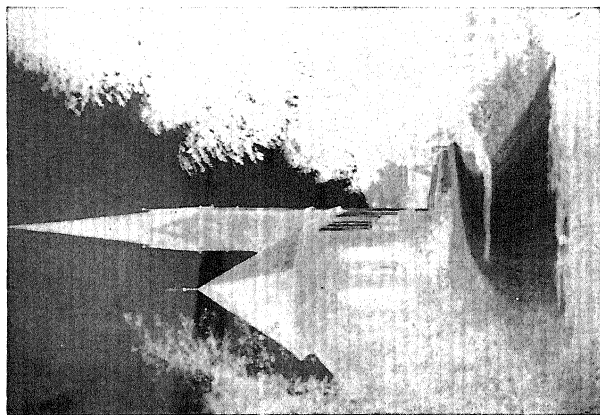


Fig. 43. —Hard Negative, the Result of Under-exposure or using the Developer too Cold.



Fig. 44. —Flat Negative, the Result of Over-exposure or using the Developer too Warm.

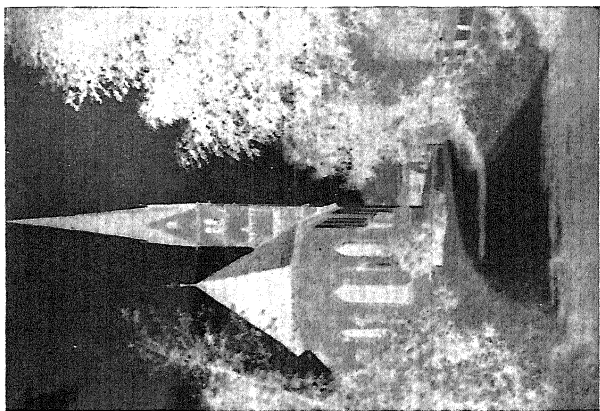


Fig. 45. —Normal Negative, Correctly Exposed and Developed.

The Different Types of Negative, corresponding to Length of Exposure.

is obtained by correct exposure. Light and shade are in this case correctly graded, and the contrast between light and dark harmoniously shaded (Fig. 45).

3. The art of development consists in taking advantage of the equalizing action of the developer, which depends on the degree of its dilution with water, and usually on the temperature of the bath. The following rules generally hold good :

More concentrated solution = hastening of development and increased contrast in negative.

More water = slowing down of development and softness — greater gradation in negative.

Further aids to intensifying or retarding the action are :

(a) Temperature of the bath ;

Warm = hastening

Cold = slowing down.

(b) Potassium Bromide ;

A 10 per cent. solution added drop by drop = delay.

4. For development we place two white dishes in front of us on the table, and prepare the developing bath, consisting of one part of concentrated Glycin solution to four parts of water.

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<p>1st Dish</p> <p>20 c.c. Glycin</p> <p>80 c.c. Water</p>	<p>2nd Dish</p> <p>20 c.c. Glycin</p> <p>80 c.c. Water</p> <p>+ 4 c.c. of 10% Pot. Bromide</p>
--	--

The temperature of the bath in Dish No. 1 should be room temperature, i.e. approximately 65° F., but that of Dish No. 2 should be cooler. The developing bath when mixed ready for use should be about half an inch deep in Dish No. 1. With plates larger than quarter-plate more of the concentrated solution should be used, and of course more water, but always in the proportion of 1 : 4 (e.g. 30 c.c. of concentrated solution require 120 c.c. water, and so on).

5. Then the glass dish is filled with fixing solution (taking care not to splash), and a bowl or pail with clean water. Both clean water and fixing bath should be at room temperature.

*Up to this point there may be a bright light in the darkroom, but the actual development must be carried out by red light only.**

6. In order to ascertain whether the exposure of a negative was :

Correct	Too short	Too long
	(under-exposure)	(over-exposure)

the plate or film is laid in Dish No. 1 with the

* Panchromatic negative material must not be developed by this method except after previous "desensitizing". In its case the maker's instructions should be religiously followed.

emulsion side upwards, in such a way that the upper surface is *immediately covered all over* with developer. This may easily be done if the dish is tipped slightly to one side, so that the liquid all goes to that side. The negative is dipped in by a corner, and is allowed to slip in (with the emulsion side uppermost) and the dish tipped back at the same time, so that the liquid may flow over in one wave. The dish is then gently rocked from side to side so that the developer is kept in motion over the emulsion layer.

7. The degree of exposure can be recognized when the picture begins to appear.

When using Glycin it appears :

Correct	Too short	Too long exposure
in 60 seconds	in 120 seconds	in 30 to 40 seconds

8. According to the time elapsing before the picture begins to appear, the following procedure is carried out :

With correct exposures development in this dish is to be continued until the half-tones, and ultimately details in the shadows, are visible. The negative is then carefully taken out, without touching the emulsion side, and held up to the red light. If the negative shows the parts which have received the brightest light as deep black, practically opaque, and all gradations from deepest black to clear glass are shown, then the negative is fully developed. It is thoroughly rinsed in the water, and afterwards placed in the fixing bath with the emulsion upwards.

With too short an exposure (under-exposure) a long time (120 seconds or more) elapses before the picture begins to appear. Such a negative is abnormal, and any further time in this developing bath will only emphasize the faults caused by the incorrect exposure because the constitution of the developer makes it too vigorous in its action. It will only blacken the high lights and leave the shadows insufficiently defined, resulting in a completely useless negative. *Under-exposed negatives must be further developed in a very dilute developer.* We therefore at once add to the bath about 2 to 3 times the quantity of water, and carefully warm it to 68° F. or at most 75° F., as at higher temperatures the gelatine may melt. Development proceeds only very slowly, the high lights are much less opaque, and more nearly approach the density of the under-exposed shadow portions.

After about 10 to 15 minutes, development is stopped, since, even if it is continued, no details will appear which have not already been brought out. A negative treated in this way will appear thin and weak, but on the whole harmoniously graded, so that it will give a good print, provided the under-exposure was not too great. Where no light reached the plate no image will appear on development.

With too long exposure (over-exposed) the high lights appear very quickly—in 30 to 40 seconds—and almost at the same time the half-tones and

shadows. The negative is then immediately taken out, and put at once into Dish No. 2. The addition of potassium bromide to this solution has a retarding action on the progress of development. In this dish the negative will gain in strength quickly, according to the degree of over-exposure, and on inspection will soon appear completely black, so that the details of the picture are lost. *Over-exposed negatives must be thoroughly well developed. They must remain in the developer until, when held against the red light, they appear to be absolutely opaque, that is to say, at least 15 to 20 minutes.* In order to make prints from such negatives, they must be reduced, a process which any photographic dealer will do for a few pence.

9. The red illumination of the dark room usually renders sufficient observation of the progress of the development extraordinarily difficult. In order to be able to examine the process without trouble we may have recourse to the process of desensitization. The negative, before being put into the developer, is first washed in a solution of pinakryptol green (1:5,000) for one minute, in which it is rendered insensitive to light. Development may now be safely carried out in white light, for instance by the light of a candle about 3 to 4 yards from the developing dish, shaded with a piece of cardboard, and the progress of the development may be followed without straining the eyes.

The following table shows at a glance the principal points to be remembered in development:

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Nature of Exposure.	First Signs of Image appear in Dish 1.	Development is continued in	Development Time.
Correct . . .	In 60 seconds	Dish 1 (normal strength)	About 5 minutes
Too short (under-exposed)	In 120 seconds	Dish 1 (diluted with 2 to 3 times its quantity of water)	10-15 minutes
Too long (over-exposed)	In 30-40 seconds	Dish 2	15-20 minutes

10. The degree of correctness of the finished negative may be recognized by the definition of the shadows, that is, the clear, transparent portions, which must be clearly defined, and the covering of the high lights.

A negative is :

Under-developed, if the lights appear insufficiently covered, and the contrast between half-tones and shadows is so slight that the whole appears flat. This is called a thin negative (Fig. 46). In this case details, even in the shadows, are clearly visible, but are very weak. The covering of the high lights is, however, absent ; they appear grey rather than black, making the whole negative seem to lack strength. A thin negative may be improved by subsequent treatment with uranium.

Over-developed, if the high lights are very heavily covered all over, and seem confused and quite opaque. As a result of the over-development the shadow portions have become too dark, and the whole negative is said to be *too dense*. In such

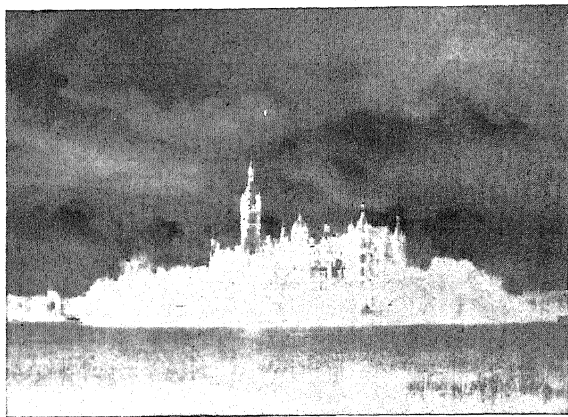


Fig. 46.
Thin Negative.
Development
stopped too
soon.

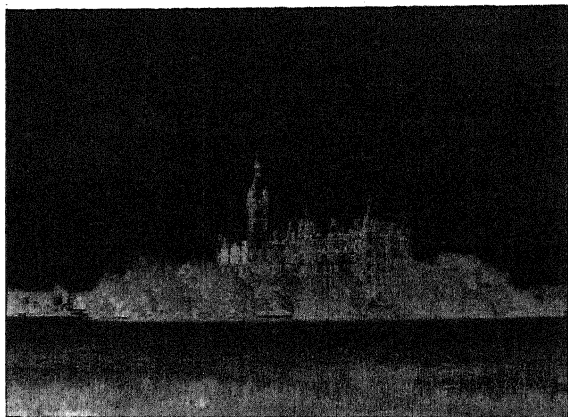


Fig. 47.
Dense Nega-
tive. Develop-
ment continued
too long.



Fig. 48.
Normal, Har-
moniously
Graded Nega-
tive.

cases the negative is also usually covered all over with a grey fog. The fog may be removed by the use of Farmer's Reducer, which generally renders the negative much lighter all over so that it will give a good print.

Correctly developed, when the contrasts between light and dark are sufficiently distinct and the whole makes a good impression. Such a negative (*normal*) shows detail in the high lights as well as in the shadows. The shadows appear clear, but not glassy, and the gradations of light and shade are well modulated. The whole negative is free from fog.

11. *Fixing* of the negative is done in an acid fixing bath, which must be at room temperature. Before the negative is placed in the fixing bath, it must be well rinsed in clean water, thus preserving the fixing bath and keeping it fresh for a longer time.

12. When the fixing is complete, the negatives are washed for some 30 to 40 minutes, preferably in running water. Plates are put into a washing bath or trough and then in a drying-rack. Films are put into a clip and hung on a line. Negatives take several hours to dry, according to the humidity of the atmosphere and the thickness of the gelatine layer. Too great warmth, and direct sunlight especially, should be avoided, as they may cause the emulsion to melt.

Films from film packs are best developed singly like plates. Development of several films at a time in one dish may easily lead to damage to

the emulsion, or to films sticking together, resulting in faulty, streaked, or spotted negatives.

Roll films, after removal of the protective paper, are fastened at both ends with a wooden peg and first run through clean water to take out the curl. Development is carried out in a special film developing dish, or with the help of a sort of bridge under which the film is drawn slowly and evenly (emulsion side down). If there are very great differences in exposure, the roll must be cut and the under- or over-exposed portions must be treated afterwards in the proper dish.

TANK DEVELOPMENT

We have so far dealt only with development, the course of which is visually controlled by the amateur himself. This necessitates the use of a dark room throughout the whole procedure, but it has the advantage of enabling the beginner to become acquainted with the changes that take place in the negative during development and fixation as well as to recognize his mistakes and to correct them as far as possible. Thus he is able to make the best of a poor photograph and even to control development by *local* treatment, especially in cases where the light contrasts in the subject have been so great that portions of the negative are relatively over- or under-exposed. This is particularly useful in landscapes with a good deal of cloudy sky.

But it is also possible to develop quite satis-

factorily without watching the process of development. A good slow-working developer (e.g. Glycin) is considerably diluted and used in one of the various developing tanks on the market. The plates or films are loaded into sheaths in a dark room with a safe (red) light, and these in turn are fitted into a grooved frame. The tank itself is then filled with developer and the frame with the plates lowered into it. Then the lid is replaced, and the tank may be brought out into the light. In this way a dozen or any smaller number of plates may be developed at one time and an averagely good negative will result unless under- or over-exposure is unduly pronounced. It is important that the temperature of the developing solution should be kept at the same degree (preferably 65° F.) throughout development. The time required for development is always given by the makers of the developer in the instructions which accompany each bottle or packet. These instructions should be carefully followed.

For the roll-film user tanks are available which enable him to dispense altogether with the darkroom.

Most of the tanks on the market are fitted with a light-tight trap so that, if desired, the developer, fixer, or plain water can be poured in while the lid is closed, and another trap, at the bottom, for emptying the tank. It is possible, therefore, after developing, to pour off the developer, fill with water, empty again, and then fill with fixing solution, without opening the tank. But, if

this is done, the greatest care must be taken before again using the tank for development, to wash it so thoroughly that not a trace of the fixing solution remains in it.

Such a tank is particularly valuable when panchromatic material is used. In this case the amateur will soon find it easy to fill his tank in complete darkness, after which the processes of development and fixation may be carried out with perfect safety in ordinary light.



Fig. 49.—Stains during Development.

Cause

The developer did not cover the whole surface of the negative at once, so that certain parts which were only covered when the dish was rocked

did not begin to develop until later. This may easily happen if there is insufficient developer in the dish, or if the negative is put in with the emulsion side downwards.

To Avoid

Developing marks cannot be removed: they can only be avoided. This can be done by using a dish amply large enough—for $2\frac{1}{4} \times 3\frac{1}{4}$ -inch negatives, for instance, use $3\frac{1}{4} \times 4\frac{1}{2}$ inches, and for $3\frac{1}{4} \times 4\frac{1}{2}$ -inch use $4\frac{1}{2} \times 6$ or 5×7 inches. A $3\frac{1}{4} \times 4\frac{1}{2}$ -inch dish requires at least 100 c.c. of developer and a $4\frac{1}{2} \times 6$ or 5×7 -inch requires 200 c.c. The dish should be tipped slightly to allow the liquid to run to one end. The plate should then be immersed, one end first, and the dish tipped back, taking care that the developer does not run over.



Fig. 50.—Finger-prints.

Cause

The emulsion was touched by moist fingers when the plate was immersed in the developer or

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taken from the holder. If the fingers were not clean, the fault will appear much worse.

To Avoid

Negatives, even after drying, should only be handled by the edge of the glass. Such marks may be removed by immersing the plate for a few minutes in a ten per cent. solution of citric acid.



Fig. 51.—Spots of Clear Glass (Air Bubbles).

Cause

Small air-bubbles formed on the gelatine when development was begun, with the result that these spots were left unaffected by the developer, resulting in round or oval white spots on the negative.

To Avoid

After placing the negative in the developing bath, make sure there are no air-bubbles on the emulsion. If there should be any, they must be

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removed immediately with a piece of wadding or a clean finger.



Fig. 52.—Black Spots—Clouds.

Cause

During development, concentrated developer was added to hasten the action.

To Avoid

Any addition of chemicals, whether to retard or hasten development, must be made after the negative has been taken out of the dish. Before replacing the negative, rock the dish from side to side several times, so that the contents are thoroughly mixed.

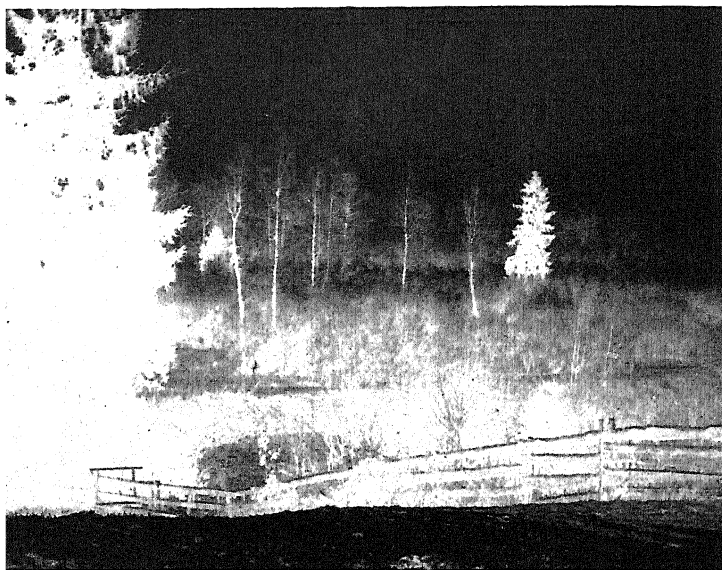


Fig. 53.—Network and Honeycomb Pattern.

Cause

The dish was not rocked after immersion of the negative, or else it did not contain sufficient solution, with the result that the developer lying on the emulsion became partly exhausted (in the high lights), and certain portions of the negative appeared lighter, producing a mottled effect. A similar mishap may occur with a developing bath which has been freshly made but not thoroughly mixed, and if the movement of the dish was in one direction only, the negative will be streaky. Developer which has become partially crystallized gives rise to similar faults. Therefore take particular care in cold weather.

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To Avoid

The dish should be filled with developer to a depth of at least half an inch, and during the whole process of development it should be lightly rocked, to allow the solution to be thoroughly well mixed. It is advisable to rock the dish both from end to end and from top to bottom. Fresh developer must be properly stirred before use. A crystallized developer may be made serviceable again by filtration.



Fig. 54.—Partial Reversal into a Positive (Solarization).

Cause

Reversal of the negative into a positive during

development, called "solarization", may be due to various causes. It is usually brought about by too long development, with inadequate dark-room illumination, to which the negative was exposed too closely and too often. It may also occur if the negative, when in the dish, is suddenly exposed to daylight or artificial light. In Fig. 54 the reversal only extends over the portion of the negative which was not shaded by the edge of the dish.

To Avoid

During the first two minutes the negative should not be held up to the light at all and afterwards only for a very short time; a rapid glance must suffice to show the progress of development. A bath of pinakryptol green before development will afford security against this trouble. Negatives which have been immersed therein are rendered insensitive even to weak white light. It is better to use a good dark-room filter for the light than a ruby chimney.

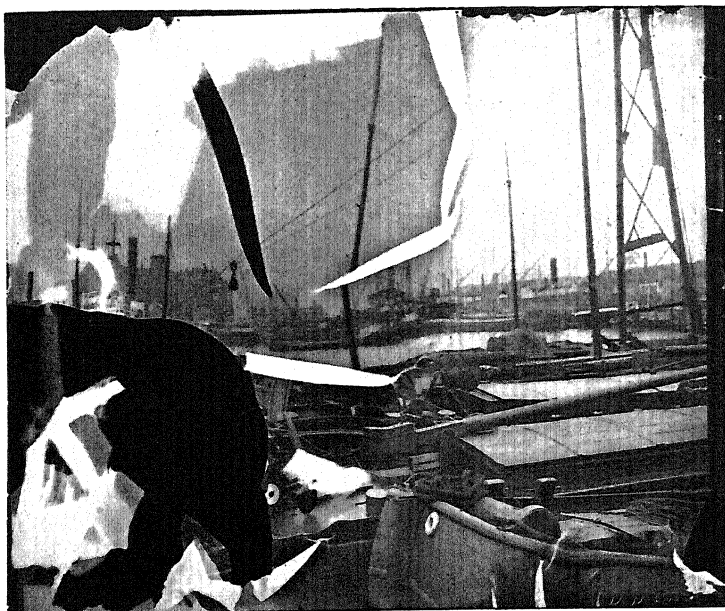


Fig. 55.—Frilling and Coming Away of the Emulsion.

Frilling of the emulsion generally occurs only at the edges of the plate, but it may happen—as in the above illustration—that large pieces, or even the whole layer, come away.

The cause of this is often due to a faulty coating of the gelatine emulsion when the plates were made. It will be aggravated if there is too much difference in the temperatures of the developing and fixing baths and the washing water. If the emulsion is touched when examining the plate against the darkroom light, this fault may occur

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at the places where the fingers rested, especially if the negative is held too often, and too closely against the warm lamp.

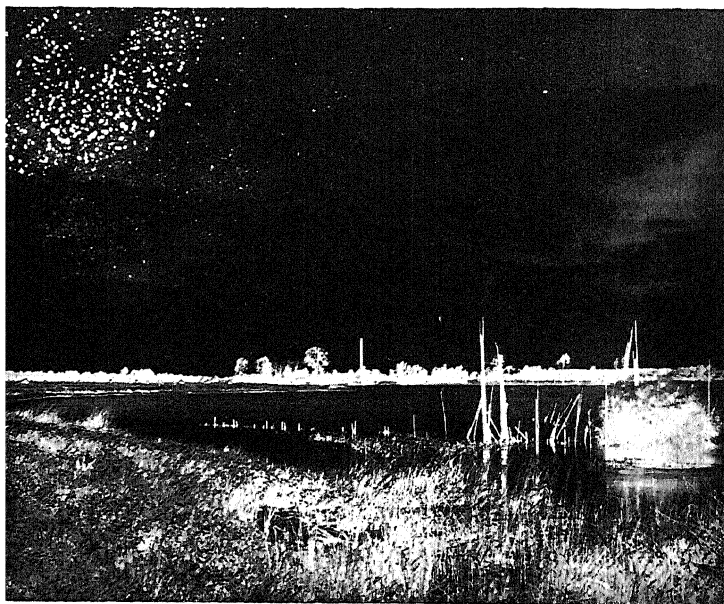


Fig. 56.—Light Spots—Bacteria.

Cause

In close, thundery, or rainy weather, and in badly ventilated or damp rooms, drying—particularly of plates—takes a long time. The air then generally contains a considerable quantity of bacteria, which settle on the gelatine layer,

and feed on it. A similar effect may be produced by flies, which suck the gelatine with their proboscis.

To Avoid

If possible, running water should be used to wash the negative after fixing. Afterwards, it is advisable to dip it for one minute in a 2 per cent. solution of formalin. In hot summer weather it is well to add chrome alum (5 grammes to the litre) to the acid fixing bath, to harden the emulsion.

To hasten the drying, the excess moisture may be removed with blotting-paper or by gently wiping it away with the palm of the hand. Plates should not be put too close together in the drying-rack. It is best to stand two plates in adjacent spaces with the glass sides facing, and then leave two or three spaces, and stand another pair with the glass sides facing. This leaves enough room for the air to circulate. If an electric fan is available it should be used, but not too close to the plates—and beware of dust!



Fig. 57.—Distortion of the Emulsion.

Cause

The moist negative stood in too warm a place to dry, either in the sun or too close to the fire, or on a radiator, causing the gelatine to soften and melt.

THE NEGATIVE

To Avoid

It is best to choose a moderately warm place in which to dry the negatives. Danger of melting the gelatine may be avoided by immersing the plates in a 10 per cent. formalin solution. A negative thus hardened will almost always stand considerable heat without melting. Hardened negatives, however, cannot be reduced or intensified.



Fig. 58.—Drying Marks on the Emulsion.

Cause

The plates were too close together in the drying-rack, and only partially dried during the

night. As a result of the altered temperature of the air, the remaining portions dried more quickly, leaving a dark outline, which appears in the print as a white line.

To Avoid

The plates should be placed in the rack with glass sides facing, with two or three spaces between each pair. It is advisable to choose a room with even temperature, airy, and free from dust, and avoid inspection of plates when once they have been put in the rack, as any alteration in the position of individual plates, or alteration in the position of the drying-rack, may cause irregular drying of the emulsion.

PRINTING

THE photographic process is concluded by the making of the print, which is called a positive because it expresses the tones of light and shade as they appear in Nature. The positive is made by allowing light to pass through the negative on to a light-sensitive photographic paper, the negative being thus "printed". Many pictures may be made in this way from one negative, whether a plate or a film. Many amateurs consider that printing, like developing, takes up too much time, but it is of very great importance for a complete understanding of various photographic questions, as it offers an excellent opportunity of obtaining a thorough knowledge of the faults of a negative, which will be of advantage in many ways in actual practice.

Papers used for positive work are divided into two classes in accordance with their reaction to light :

1. *Daylight*—or printing out papers.
2. *Gaslight*—or development papers.

Positive papers, like plates and films, contain silver salts as the light-sensitive material, and in order to make the picture appear, these salts must be converted into black metallic silver.

The following paragraphs explain the reaction which takes place on exposure to light, which is different in the two groups owing to difference in the chemical composition of the light-sensitive substance employed.

DAYLIGHT PAPERS

In papers belonging to this group the change in composition takes place directly in the light, and is, therefore, visible. Herein lies the great advantage of these papers, which enable one to produce a good print without difficulty by simply watching the gradual darkening of the paper.

Daylight papers are very easy to use, and also very convenient, since their very slight sensitivity to light makes it possible to dispense with a dark-room. A disadvantage is that a long exposure may be necessary to produce a picture, especially in the winter. The time required varies considerably with the type of paper, the density of the negative, the light, and the time of day. The method of procedure is briefly as follows:

When the negative is quite dry, and the glass or celluloid side thoroughly cleansed from marks (dried spots of water, etc.) with a piece of linen rag, it is laid *emulsion side upwards* in a printing frame—in the case of films a piece of clean glass is put in first—and a piece of the paper is taken out of the packet in a dark corner of the room, and laid emulsion side downwards on top of the negative. After the cover has been put

on, the necessary contact of negative against paper is ensured by closing the safety-spring. The frame is then put in the window, in full daylight. Printing should not, as a rule, be done in direct sunlight.

The progress of the printing may be watched by occasional examination in the dim light of the room. For this purpose only one catch should be undone, and the corresponding side of the cover turned back, so that the paper may be carefully raised. The paper should not, however, be bent back too far, as the emulsion is liable to crack. If the whole of the frame were opened at once the paper would certainly be shifted, and a second printing would begin in the new position of the paper.

If the picture is not strong enough, the frame must be put back into the light. No rule can be laid down for the duration of the exposure. It may take a few minutes, or several hours. It is very important that the picture shall be dark enough, and it must be deeper than the finished picture is to be, as the depth is weakened in the subsequent baths.

When the picture has attained the required depth, the frame is taken away from the window and the sheet of paper taken out of it. The print may now be put into the gold toning and fixing bath, where it will acquire its fine brown tones. It is afterwards thoroughly cleansed by rinsing in several fresh lots of clean water at room tem-

perature, and is then dried. The process is easier still if "self-toning" paper is used, which contains in its emulsion the necessary quantity of toning salts, and the print has only to be put into the ordinary acid fixing bath. Full instructions for use of this paper are always given on the packet.

It should be noted that, in printing, the results obtained with various kinds of negatives (thin, soft, dense, hard, etc.) will not be equally good unless special care is taken. In order to obtain the best possible result every time, it should be borne in mind that the longer the printing takes, the more the contrast will be softened down. Consequently :

Direct sunlight on the print
produces soft, harmoniously graded pictures.

Printing in the shade, or diffused daylight,
produces strong, contrasty pictures.

In practice, therefore, one should print as follows :

Weak and thin negatives
in the shade or diffused daylight.

Hard and strong negatives
in direct sunlight.

Prints of fine gradation may also be obtained in the sun from negatives which are too hard and contrasty, if the printing frame is covered with a piece of ground glass. For very thin and

soft negatives specially contrasty papers may be obtained.

GASLIGHT PAPERS

Gaslight papers have an emulsion similar to that of negative material ; so that exposure produces a "latent" or invisible image, which must be rendered visible by treatment in a developing bath. Hence the name "development papers". There are several varieties of these bromide and gaslight papers. For amateur purposes, gaslight papers have proved to be more reliable in use. This book will therefore deal only with this variety. The name gaslight paper was applied to this paper in the days when gas was the general means of illumination, and it is still commonly used, though it has nowadays no real relation to the actual source of illumination.

WORKING WITH GASLIGHT PAPERS

Gaslight papers are much more sensitive to light than daylight papers. Printing need not, however, be done in a dark room, but in any ordinary room, and yellow light is sufficient ; even the subdued light of an ordinary lamp may be safely used, with care, for developing. Gaslight papers are particularly useful in the darker months, because any artificial light will serve for the exposure, and produce prints which are more lasting than those on daylight paper in the relatively short time of a few minutes.

The most important point to consider when working with gaslight paper—and here is the whole difficulty—is to give the *right length of exposure*, because the picture is not immediately visible after exposure. This must be very accurately calculated if a good picture is to be obtained. In order to learn the technique quickly, it is advisable to confine oneself to the use of one particular brand of paper, and even if anything goes

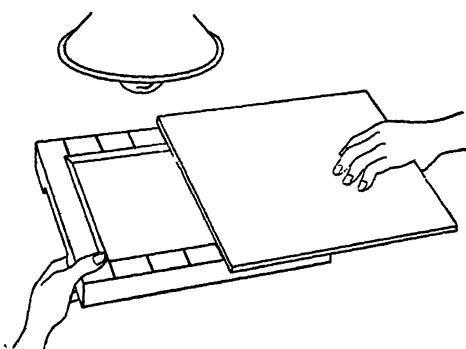


Fig. 59.—Trial Exposure.

wrong, not to change to another make, as this will not put things right. It is best to keep to a tried method of working, which will lead easily to success, until one has gained the necessary experience.

The correct length of exposure may best be determined by means of the following test, making a trial exposure.

First mark off a scale on the long sides of the printing frame, the distance between the marks

THE PRINT

being about half-an-inch, and have ready a cardboard cover slightly larger than the frame. The sheet of gaslight paper is then placed on top of the negative, which has been previously laid in the frame, emulsion side up, and the back of the frame is then closed and the catches fastened.



Fig. 60.—Print Exposed in Strips.
The strips were exposed to the light for 5, 10, 15, 20 and 25 seconds respectively.

The frame is then completely covered with the cardboard cover, and placed in a bright light. The cover is at first drawn back only as far as the first mark on the scale, and the light allowed to act on the paper for five seconds, then the cover is withdrawn as far as the next mark on

the scale, and the paper exposed for another five seconds, and so on, until the whole sheet has been exposed. When this has been done, the frame is again completely covered with the cardboard cover, and taken away from the light. Then comes the development of the paper, which should not take more than 1 to 1½ minutes, the dish being continually rocked. The paper is then quickly washed in clean water, and put into the fixing bath. It can be taken out of the fixing bath in a few moments, and when examined in a bright light the picture appears in strips of varying degrees of darkness according to the duration of the exposure. It is easy to see which strip corresponds to the correct exposure. In a good photograph the high lights must be bright, the half-tones of perfect gradation, and the shadows intensely black.

In Fig. 60 the third strip possesses these qualities, so that this negative must be exposed 15 seconds with this particular paper.

DEVELOPMENT

The best developer to use is metol-hydroquinone, which is diluted with the quantity of water indicated on the bottle. The temperature of the developing bath is of great importance—it should be that of the room, about 65° F. Special attention should be paid to this point in summer and winter, since if the developer is too cold it works too slowly, and the pictures appear hard, and

grey rather than black, whereas if it is too warm it brings up the picture too rapidly, and it will be weak and soft with coal-black, blotchy shadows encroaching on the high lights, with the result that the whole picture appears to be veiled.

FIXING

The print must then be put into an acid fixing bath, which immediately puts an end to development. The concentration of this bath must be less than in the case of the negative process, because too strong a solution will frequently cause bubbles to appear on the surface of the picture in the subsequent washing. The bath is generally diluted with double the quantity of water, and should be kept at room temperature. The fixing is complete after about 10 minutes, during which time the bath should be constantly moved, in order to prevent individual sheets of paper from sticking together. Afterwards they are washed thoroughly for about half an hour in clean water, frequently changed, and then dried in the air. Never leave the prints in water all night.

In the section on the negative process the various kinds of negatives were fully described, and it is important that the amateur should be quite clear as to their nature. There are several different kinds of gaslight paper—usually known as soft, normal, and contrasty or vigorous—which possess different properties, and may be

selected to suit the characteristics of each particular negative. The photographer who wishes to get only perfect prints from his negatives, will not attempt to use one type of paper in every case. A sound practical rule is always to choose a paper whose qualities are exactly the opposite of those of the negative.

The following illustrations will be of assistance in choosing the most suitable paper.

A negative which has been too long developed, and is therefore heavily covered, or dense, and also an under-exposed (hard) negative, requires a sensitive, soft paper, as this will tone down the contrasts.

Negatives which have not been developed long enough (thin negatives), and over-exposed, flat and feeble negatives, must be printed on a vigorous, contrasty paper in order to make the most of the slight contrasts between light and shade.

Perfect negatives, that is, those with good gradation in the high lights and half-tones and full details in the shadows, are, of course, printed on normal paper. Sometimes, however, a soft paper may be found to give still better results.

When in doubt as to which paper to use, the beginner will do well to make a print first on normal paper. If the shadows are too dark, so that the details are lost and the high lights a chalky white, without detail, then a more sensitive, that is, a soft paper, should be used. If on the other hand the high lights are not pure

Fig. 61.
Print from a Hard
(Under-exposed)
Negative on Vigor-
ous Paper.

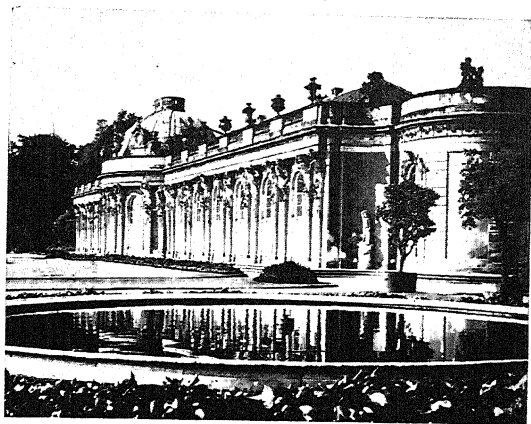


Fig. 62.
Print from the
same Negative on
Normal Paper.

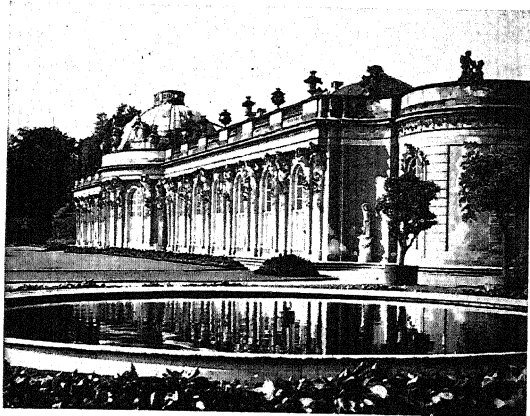
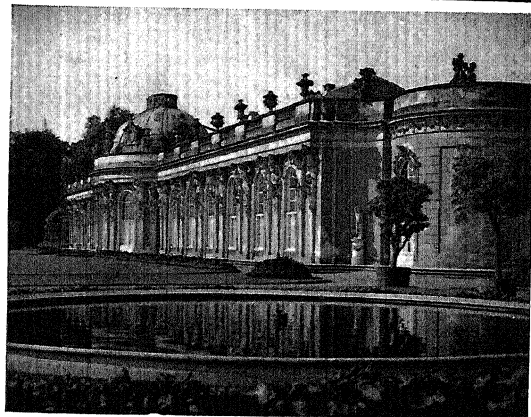


Fig. 63.
Print from the
same Negative on
Soft Paper.



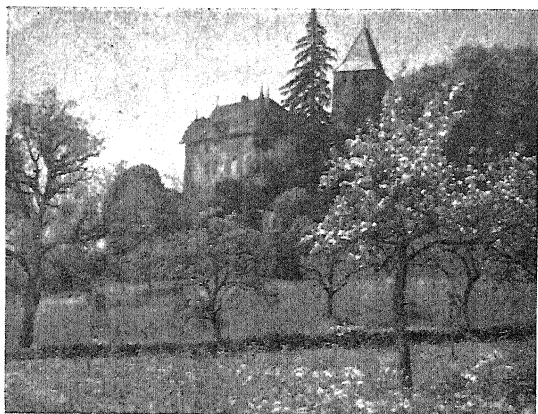


Fig. 64.
Print from a Soft
Negative on Soft
Paper.

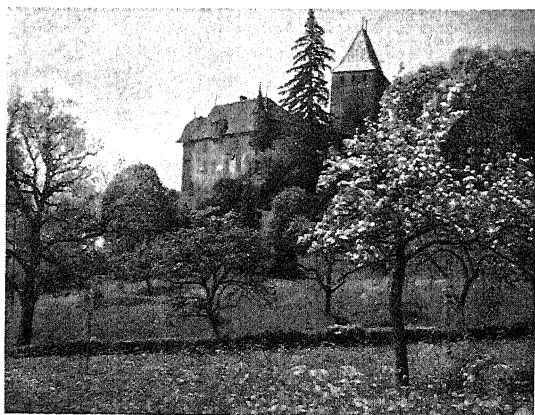


Fig. 65.
Print from the
same Negative on
Normal Paper.

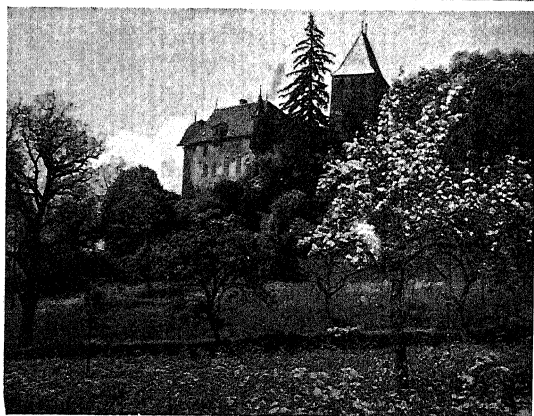


Fig. 66.
Print from the
same Negative on
Vigorous Paper.

white, but veiled with grey—especially in the case of lightly covered (thin) negatives—then a vigorous paper should be used.

When changing the type of paper, do not forget that a corresponding change must be made in the length of exposure. The three types of paper have different degrees of sensitiveness, and it is very important to remember this. *Vigorous* papers require a *longer* exposure than normal papers, whereas *soft* papers require a *shorter* exposure than normal. This should be taken into consideration when making the trial exposure, and with vigorous papers the exposure given to the various strips should vary by 10 seconds ; with soft papers by only 3 seconds.

If the correct paper has been chosen, but too short an exposure given, the picture appears comparatively slowly, and at the end of the time of development indicated above, is still lacking in strength. The high lights are quite clean, but without detail, and the shadows are not dark enough but grey (Fig. 67).

If, on the other hand, the print was over-exposed, the opposite result is obtained: the picture appears extraordinarily quickly, it is lacking in strength, and with continued development becomes quite black (Fig. 68).

The beginner will very soon learn the difference between under- and over-exposure if he studies the appearance of the picture after one minute's development. If the picture is finished

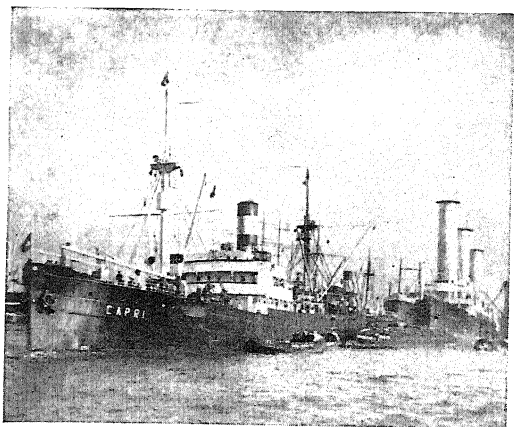


Fig. 67.
Under-exposed
Print.

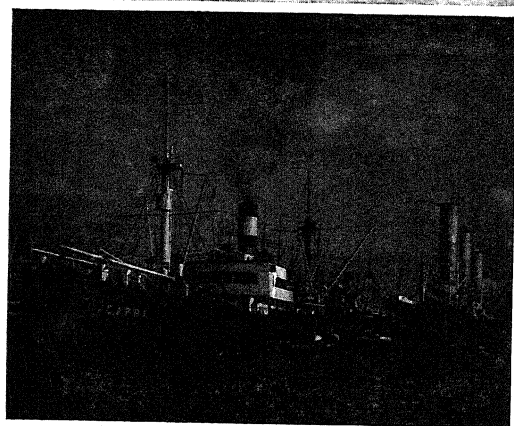


Fig. 68.
Over-exposed
Print of a Normal
Negative on
Normal Paper.

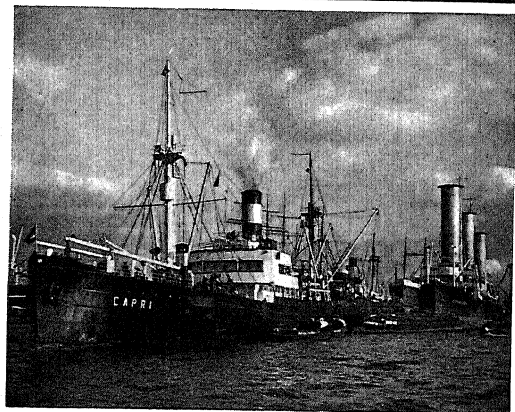


Fig. 69.
Correctly Printed.

in much less than a minute, the print is over-exposed, but if it is not complete in one minute, the print is under-exposed.

There is a method of modifying the gradation of a print to some extent, by fixing upon a certain length of exposure, and altering the developer accordingly. With papers of similar type, e.g.—

Short exposures and concentrated developer with the addition of a few drops of 10 per cent. solution of potassium bromide.	=	hard and contrasty prints.
--	---	----------------------------

Longer exposures and diluted developer.	=	soft and delicate prints.
---	---	---------------------------

Gaslight papers, besides differing in regard to the type of emulsion (normal, vigorous, soft), are also made in different types according to the surface and colour of the paper. For example, the following kinds may be obtained: glossy, semi-matt, matt, matt-rough, rough, linen, coarse-grained, etc., and almost all these in both white and cream.

With these many varieties, it is possible considerably to improve the artistic quality of a print. It should be remembered that *white paper always increases the contrast of a picture, whilst cream softens it*. Further, a glossy paper should always be used for small pictures (up to $2\frac{1}{4} \times 3\frac{1}{4}$ inches), as it brings out the greatest possible amount of detail. A similar result may be obtained with

PHOTOGRAPHY WITHOUT FAILURES

semi-matt papers, whereas matt surfaces should be reserved for medium sizes ($3\frac{1}{4} \times 4\frac{1}{4}$ inches) upwards. With such papers all excessive detail may be reduced, where a rather flat effect is desired.

Working with gaslight papers is really very easy, but it is possible to make mistakes, although, as in actually taking the picture and in developing it, these are usually due to the worker's carelessness.

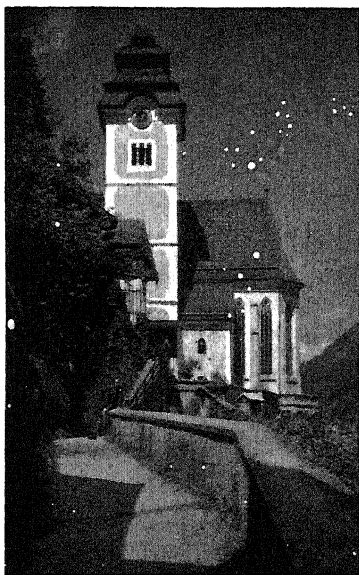


Fig. 70.—White, Round Spots.



Fig. 71.—Streaks and Spots.

The spots are caused by a series of air-bubbles, which are due to the paper not being slipped sideways into the developer, but being laid in

flat. In the development of gaslight paper, as in the development of a negative, the dish must be tipped up, and one side of the paper dipped in the liquid, the emulsion side of the paper being uppermost. Care should be taken that there is sufficient liquid in the dish, otherwise it may not be enough to cover the whole sheet at once, and this would result in streaks or spots of different shades, rendering the print useless. A similar result might be obtained if the sheet

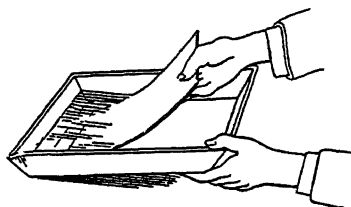


Fig. 72.—Laying the Sheet of Paper in the Developing Dish.

of paper were laid in the developer emulsion side downwards, so that it stuck to the bottom and was not acted upon by the developer equally all over.

It is essential that every amateur who wishes to make his own prints should understand clearly the cause of the various faults which occur, in order that he may avoid them and thus be saved much annoyance and waste of time and material.

The following table of faults which most frequently arise will be of service :

PHOTOGRAPHY WITHOUT FAILURES

Fault.	Cause.	To Avoid.
The picture does not come up in the developing bath	The sheet of paper was laid upside down in the printing frame	The paper always curls one way, the inner side of the curve being the emulsion side
The picture is not sharp anywhere, whereas the negative is quite sharp	The negative was put into the frame with the emulsion side outwards	Before putting in the negative, always make sure which is the emulsion side, and this side must be uppermost in the frame
The prints are not white, but yellow	1. The developer was contaminated by traces of fixer	1. Greater cleanliness should be observed. Fingers should be thoroughly washed after contact with fixing bath
	2. Developer was too strong, too cold or too warm	2. Follow the directions for dilution. Temperature 65° F.
	3. The fixing bath was exhausted	3. Renew fixing bath frequently
The picture shows brown spots	1. Parts of the sheet were at times out of the developing or fixing bath	1. The dishes should be well filled and kept constantly in motion
	2. The emulsion was touched with fingers moist or soiled from the fixing bath	2. Hold the paper only by the edges
The picture has bubbles on the surface	1. Fixing bath too concentrated or exhausted	1. Follow the instructions on the tin exactly

THE PRINT

Fault.	Cause.	To Avoid.
The picture is yellow all over	2. Too great difference of temperature between developing and fixing baths	2. All baths should be at room temperature, 65° F.
	1. Development too long, after too short exposure	1. Make trial exposure (p. 104)
	2. Contamination of developer with fixing bath, or vice versa	2. Greater cleanliness
	3. Insufficient washing after fixing	3. Washing should be continued for at least 20 minutes in frequently changed water
The print shows fine black lines or grey spots	4. The prints were too close together in the fixing bath, and were not properly fixed	4. The fixing dish must be twice the size of the paper and filled almost to the brim
	Rubbing and pressure on the emulsion surface	After drying, rub the prints with a piece of cotton-wool dipped in alcohol
White pinholes	Very small air-bubbles in the developer or dust on the negative	After putting in the paper, the developing dish must be quickly rocked. The negative must be thoroughly cleaned on both sides

PHOTOGRAPHY WITHOUT FAILURES

Fault.	Cause.	To Avoid.
Dirty, greenish tones	Too long exposure, too weak developer, or very exhausted bath	Make exposure test (see p. 96). Dilute according to instructions, or use a fresh bath
The white border is fogged	The paper was not properly stored	Avoid too great heat, moisture, and rooms where harmful gases or steam are present
Black spots and dots	Developer not properly dissolved, or paper touched with fingers too warm or soiled with developer	Rub the print when wet with a piece of cotton-wool dipped in alcohol, after fixing
After fixing yellow - brown spots appear	Parts of the paper were not covered by the fixing bath	Keep the prints well covered and move them about frequently

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